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NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/2
NATIONAL DAM SAFETY PROGRAM. CHADWICK LAKE DAM (NY00509), HUDSO--ETC(U)
SEP 78 J J WILLIAMS DACW51-78-C-0035

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LEVEL

HUDSON RIVER VALLEY

QUASSAIK CREEK, ORANGE COUNTY

NEW YORK

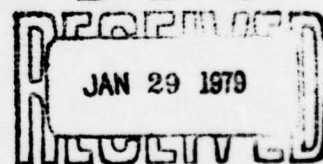
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CHADWICK LAKE DAM

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

DDC



NY 00509

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DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, NEW YORK
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10007

2 OCT 1978

NANEN-F

Honorable Hugh L. Carey
Governor of New York
Albany, New York 12224

Dear Governor Carey:

The purpose of this letter is to inform you of a clarification of the guidelines used by this office in assessing dams under the National Program of Inspection of Dams.

Office of the Chief of Engineers has recently provided a clarification that dams with seriously inadequate spillways are to be assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The following dams in your state have previously been assessed as having seriously inadequate spillways, with capability to pass safely only the percentage of the probable maximum flood as noted in each report. They are now to be assessed as unsafe:

<u>I.D. NO.</u>	<u>NAME OF DAM</u>
N.Y. 59	Lower Warwick Reservoir Dam
N.Y. 4	Salisbury Mills Dam
N.Y. 45	Amawalk Dam
N.Y. 418	Jamesville Dam
N.Y. 685	Colliersville Dam
N.Y. 6	Delta Dam
N.Y. 421	Oneida City Dam
N.Y. 39	Croton Falls Dam
N.Y. 509	Chadwick Dam (Plattenkill)
N.Y. 66	Boyd's Corner Dam
N.Y. 397	Cranberry Lake Dam
N.Y. 708	Seneca Falls Dam
N.Y. 332	Lake Sebago Dam
N.Y. 338	Indian Brook Dam
N.Y. 33	Lower(S) Wiccopee Dam (Lower Hudson W.S. for Peekskill)

NANEN-F
Honorable Hugh L. Carey

<u>I.D. NO.</u>	<u>NAME OF DAM</u>
N.Y. 49	Pocantico Dam
N.Y. 445	Attica Dam
N.Y. 658	Cork Center Dam
N.Y. 153	Jackson Creek Dam
N.Y. 172	Lake Algonquin Dam
N.Y. 318	Sixth Lake Dam
N.Y. 13	Butlet Storage Dam
N.Y. 90	Putnam Lake (Bog Brook Dam)
N.Y. 166	Pecks Lake Dam
N.Y. 674	Bradford Dam
N.Y. 75	Sturgeon Pool Dam
N.Y. 414	Skaneateles Dam
N.Y. 155	Indian Lake Dam
N.Y. 472	Newton Falls Dam
N.Y. 362	Buckhorn Lake Dam

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening, and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

Consequently, it is advisable to implement the recommendations previously furnished in the reports for the above-mentioned dams as soon as practicable.

It is requested that owners of these dams be furnished a copy of this letter and that copies be permanently appended to all reports previously furnished to you.

Sincerely yours,

CLARK H. BENN
Colonel, Corps of Engineers
District Engineer

HUDSON RIVER BASIN

Name of Dam: Chadwick Lake Dam
County and State: Orange County, State of New York
Inventory Number: NY 509

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared by: O'Brien and Gere Engineers, Inc.

For: New York State
Department of Environmental Conservation

Date: July 26, 1978

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21. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization. Chadwick Lake Dam was judged unsafe, non-emergency due to a seriously inadequate spillway.		

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Chadwick Lake Dam

State Located: New York

County Located: Orange County

Stream: Quassaick Creek

Date of Inspection: June 26, 1978

ASSESSMENT OF
GENERAL CONDITIONS

A considerable portion of the earth embankment of the Chadwick Lake Dam (formerly known as Plattekill Dam) is heavily overgrown with trees and underbrush.

The spillway section was analyzed for stability and found to be unstable for the ice loading condition. In addition, the foundation reaction was found to be outside of the middle third for the reservoir elevation at the top of the embankment. The spillway should be strengthened to provide adequate factors of safety. Inspection of the concrete spillway structure revealed serious spalling, some undermining and a need for surface repair.

The spillway was found to be capable of passing only 36 per cent of the PMF before overtopping of the embankment. Therefore, the spillway should be considered seriously inadequate as described in Engineering Technical Letter no. 1110-2-234. Around the clock surveillance should be provided during periods of unusually heavy rainfall. A warning system should be established for the protection of downstream residents and businesses.

O'BRIEN & GERE ENGINEERS, INC.

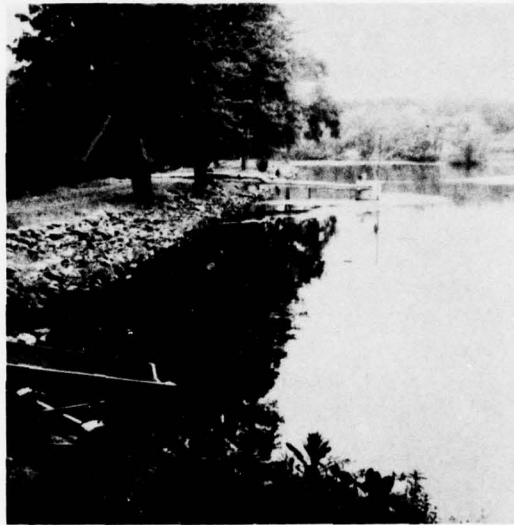
John J. Williams
John J. Williams, P.E.
Vice President

Approved by: *Clark H. Benn*

Clark H. Benn
Colonel, Corps of Engineers
District Engineer

Date: 21 September 78

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UPSTREAM VIEW OF DAM



DOWNSTREAM SLOPE OF EMBANKMENT

TABLE OF CONTENTS

<u>TEXT</u>	<u>PAGE</u>
Assessment of General Conditions	
Overall View of Dam	
Section 1 - Project Information	1-6
Section 2 - Visual Inspection	7-9
Section 3 - Hydraulic/Hydrologic	10
Section 4 - Structural Stability	11-12
Section 5 - Assessment/Remedial Measures	13-14

FIGURES

Figure 1 - Regional Vicinity Map
Figure 2 - Geologic Map
Figure 3 - General Plan
Figure 4 - Details of Outlet Pipe
Figure 5 - Plans and Sections Discharge Pipe
Figure 6 - Flow Line and Land Map

APPENDIX

Field Inspection Report
Photographs
Hydraulic and Hydrologic Calculations
Application Data and Previous Inspection Report
Stability Analyses

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM CHADWICK LAKE DAM ID# NY 509

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with contract #1467.021 between O'Brien and Gere Engineers, Inc., and the New York State Department of Environmental Conservation.

b. Purpose of Inspection - The purpose of this inspection is to evaluate the structural and hydraulic conditions of Chadwick Lake Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 PROJECT DESCRIPTION (From drawings on file with the New York State Department of Environmental Conservation).

a. Description of Dam and Appurtenances - Chadwick Lake Dam and Chadwick Lake are located in the Town of Newburgh in Orange County, about four and one half miles northwest of the center of the City of Newburgh. In the year 1926, Chadwick Lake Dam (formerly known as Plattekill Dam) was constructed across Quassaick Creek, which drains into the Hudson River along the southern boundary of the City of Newburgh.

The dam is an earth fill embankment with a concrete core wall and consists of the following materials:

1. Upstream earth fill - materials not indicated
2. Core wall - concrete, no reinforcing indicated
3. Downstream earth fill - materials not indicated
4. Upstream face of embankment - Rock paving, 12" thick
5. Downstream face of embankment - Top soil facing, 12" thick.

The dam has a maximum height of about 37 feet and is approximately 570 feet long including the spillway. The top width of the dam is 20 feet wide and consists of an earth surface. The upstream slope is $2\frac{1}{2}$ horizontal to 1 vertical and has a rock-paved face (riprap set in place). The downstream slope is 2 horizontal to 1 vertical covered originally with a 12" deep layer of topsoil. The topsoil layer extends over

the top of the embankment to the upstream rock paved surface. Refer to Figure 5 for details showing the transverse section of the embankment.

There are two separate outlet works to release water from the reservoir. One, located along the upstream toe of the embankment approximately at the center of the dam, consists of a 36-inch cast iron pipe and a concrete inlet structure, with trash rack. The pipe has a series of 8 concrete cut-off walls, located along the pipe at the pipe joints. Flow is controlled by means of a 36" gate valve located at the outlet end of the pipe. The gate valve and its gear reduction handwheel operator is located in a concrete and brick gatehouse near the downstream toe of the embankment. Figure 5 shows the details of this outlet pipe. The other outlet works is located alongside the left abutment of the spillway and consists of two 30-inch cast iron pipes and a concrete inlet structure, with trash rack, set in the upstream slope of the embankment. The pipes have a series of 3 concrete cut-off walls and outlet into a concrete slope protection structure. The concrete slope protection structure slopes downward with a drop of 3 feet in a length of 18 feet. Flow is controlled by means of two 30-inch gate valves, located with their geared handwheel operators in a concrete and brick gatehouse. Figure 6 shows the details of this outlet works. The elevations of the two different outlet works are such that the 36-inch pipe may be used to drain the reservoir, and the two 30-inch pipes may be used to release water from about ten feet below the normal pool elevation.

The dam and appurtenant structures were originally built for the Newburgh Bleachery to insure a steady water supply for the Bleachery located downstream in the City of Newburgh. The Bleachery has been discontinued and the dam and reservoir are owned by the City of Newburgh and used as a source for water supply. The water filtration plant is located a short distance downstream of the dam. The area surrounding the reservoir is also used for recreational purposes and is maintained by the city water department.

Neither the "Application for the Construction or Reconstruction of a Dam" originally filed with the State of New York, Department of State Engineer and Surveyor nor the existing plans indicate who designed the dam and appurtenances. Details concerning the construction history were not made available.

b. Size Classification - The Chadwick Lake reservoir was designed for a storage volume of 800 million gallons (2,450 acre-feet) at the spillway crest elevation of 450 feet mean sea level (MSL). The maximum height of the dam is 37 feet. Since the normal storage volume is 2,450 acre-feet, the dam is in the intermediate size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

c. Hazard Classification Chadwick Lake Dam creates an impoundment of 2,450 acre-feet. Failure of this dam would release a flood wave of extreme magnitude. The immediate effect would be to seriously damage or destroy the water filtration plant of the City of Newburgh, shutting off its source of potable water. The flood wave would then continue downstream causing serious damage to homes, highways, utilities and businesses. The valley of Quassaick Creek is lightly populated immediately downstream of the dam, and the community of Gardnertown is located about $1\frac{1}{2}$ miles downstream. From that point, an additional 2 to $2\frac{1}{2}$ miles downstream to Glenwood Park and the City of Newburgh, the housing density increases significantly and the potential loss of life can be considered high. Therefore, the Chadwick Lake Dam is in the high hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.3 PERTINENT DATA (From information furnished by the New York State Department of Environmental Conservation and the visual inspection)

a. Drainage Area - The drainage area of Chadwick Lake is about 13.5 square miles. This has been confirmed from use of United States Geological Survey quadrangle sheets (7.5 minute) for Newburgh, N.Y. and Clintondale, N.Y. The surface area of the lake is 0.41 square miles at the spillway crest (elevation 450.0).

b. Discharges - Discharge from the lake can be accomplished through the operation of one 36" gate valve and two 30" gate valves. In addition a new intake structure with a pumped discharge has been installed to supply the filter plant.

A small discharge is being released to augment the spillway overflow and maintain flow in Quassaick Creek downstream.

Chadwick Lake is being used primarily as a water supply reservoir.

c. Reservoir Data

Normal Operating Pool (Spillway Elevation 450.0)

Length - 8,500 feet
Area - 260 acres
Volume - 2,450 acre-feet

Top of Dam (Elevation 455.0)

Length - 8,700 feet
Area - 278 acres
Volume - 3,840 acre-feet

d. Dam Data

Type - earth embankment
Top Elevation - 455.0 feet (MSL)
Streambed elevation at centerline of dam - Approximately
418 feet
Length - 570 feet, including spillway
Top width - 20 feet
Side slopes - upstream slope $2\frac{1}{2}$:1 (horizontal to vertical);
downstream slope 2:1
Zoning - none indicated
Impervious Core - concrete
Cutoff - plans indicate a concrete core wall carried to
rock or a firm foundation about 7 to 8 feet below
the reservoir bed
Spillway - concrete, gravity cross-section, with concrete
abutment wing walls, built on ledge rock. The
plans and visual inspection are not in agreement as
to the shape of the cross-section

e. Outlet Works - The outlet works now installed at the dam
consist of three main elements as follows:

1) Two 30-inch cast iron pipes are located alongside the left
abutment of the spillway. These pipes are set at an elevation so as to
release water from a level 10 feet below the spillway crest. Flow is
controlled by a 30-inch manually operated gate valve on each pipe
located at the outlet end of the pipe. Under normal conditions these
pipes are seldom used.

2) A 36-inch cast iron pipe is located at approximately the center of the dam. This pipe is set at an elevation with its invert 30 feet below the spillway crest level and was originally used to drain the lake. Flow is controlled by a 36-inch manually operated gate valve located at the outlet end of the pipe.

3) A new intake structure has been added to obtain water for water supply to the filtration plant. This consists of a cylindrical metal intake tower mounted on the inlet structure for the 36-inch pipe. This structure supports a low head propellor type pump which delivers water over the top of dam, through a 12-inch pipe, to the supply pipe to the filtration plant. This enables the plant operator to draw water from the lake at a higher level than the 36-inch pipe in order to provide a better quality of water. The pump is driven by a 10 horsepower motor; the 12-inch discharge pipe lies on the downstream surface of the embankment. At its lower end, near the toe of slope, this pipe is interconnected with the 36-inch cast iron pipe through a 20-inch connection and there is a 24-inch pipe supplying the filtration plant. The 36-inch pipe is capped with a blind flange and there is a 12-inch blow-off pipe for releases to Quassaick Creek if desired.

4) Two "octopus" type aerators have been installed just upstream of the upstream toe of the embankment to improve the oxygen content of the water being drawn from the lake. These aerators are supplied by a 2-inch pipe from a 15-horsepower air compressor located on the lake shore near the left abutment of the dam.

f. Engineering Data - The information available for review of Chadwick Lake Dam included:

1) A set of four drawings for the Plattekill Dam (now known as Chadwick Lake Dam) and appurtenances.

2) Copy of "Application for the Construction or Reconstruction of a Dam" for Plattekill Dam, filed December 23, 1925, approved February 1, 1926

3) Copy of Parts 1 and 2, Inventory of Dams in the United States, giving data on Plattekill Dam.

4) Rainfall Data filed with the application, 2), for the years 1900 to 1918.

5) Dam Inspection Report, dated 9/18/74

6) Testing Laboratory Report for sand and cement briquettes, dated December 23, 1926.

1.4 OPERATING AND MAINTENANCE PROCEDURES

a. Operation - Normal withdrawal of water from the reservoir for water supply purposes is by means of the intake structure described in item e. 3). above. The reservoir may be drained part way (to elevation 439.0) by means of the two 30-inch outlet pipes. The use of the 36-inch outlet pipe to drain the reservoir completely (to elevation 420.0) would require removal of the 36-inch blind flange at the pipe outlet to make use of the full capacity of the 36-inch pipe.

b. Maintenance of Dam and Operating Facilities - The growth of large trees and dense underbrush on the earth embankment are indications of poor maintenance. The spillway structure is in need of extensive surface repair to correct spalling and undermining damage. The spillway inlet channel needs dredging and clearing to provide free flow of water to the spillway. The spillway outlet channel needs clearing of trees, brush and debris to provide a free flow outlet channel. All of the above should be carried out on a continuing basis. The intake structure for water supply appears to be well maintained and is in constant operation. According to the water plant superintendent, the outlet valves on the 36-inch and two 30-inch drain pipes are operated twice a year to insure their operating condition when needed.

c. Flood Warning System - Operating personnel stated that no flood warning system has been established.

SECTION 2 - VISUAL INSPECTION

2.1 FINDINGS

a. General - The field inspection of Chadwick Lake Dam took place on June 26, 1978. The lake water surface elevation was about 451 feet Mean Sea Level during the inspection visit. No underwater areas were inspected.

b. Embankment - The riprap on the upstream face appears to have been hand placed, but is not grouted in place. The top surface is a lightly macadamized surface with loosely placed large stones. The upstream face has considerable small brush and grass growing at the top of the slope. From the size of the trees their root systems should be extensive. Several trees had been cut off near their base, leaving a short stump and the root system in place. At one location a tree had broken off and fallen, creating some problems. The earth fill displaced by the root movement has been replaced by about 3 feet of stone fill, according to Mr. Haffen, the Plant Superintendent of the Filter Plant. New riprap has been placed to reinforce the existing riprap.

The downstream face is well covered with brush and trees, virtually a wooded area. There are no significant signs of seepage on the upper portion. There is some surface wetness near the toe, which could be from surface run-off. In an area near the left abutment of the spillway there is an exposed rock face just below the toe. This rock face has a depth of about 12 feet and drops down to the spillway outlet channel. The exposed rock appears to be a hard shale formation. The spillway outlet channel runs parallel to the downstream toe in this area, and is strewn with many large boulders and debris. Since the outlet channel runs parallel to the toe and water from the spillway flows in random directions among the boulders, it is difficult to check for seepage at the toe. At the main outlet valve house there is an open 8-inch pipe flowing partially full (estimated at about $\frac{1}{2}$ cubic feet per second). This flow is dispersed among the boulders and underbrush along the toe. Immediately below the toe at the left abutment is a marshy area. Whether the water creating this is caused by seepage through the embankment or from side slope sources is not discernable. There is no visible evidence of erosion of the earth fill.

c. Spillway - The plans indicate a concrete gravity type spillway, 175 feet long, with vertical upstream face, sloping downstream face, an ogee crest, and earth fill to elevation 448.0 (MSL) against the

upstream face. The concrete is shown about 2 feet into the underlying rock. Near the right abutment the gravity section becomes a concrete sill, 4 feet wide and about 3 feet deep into the rock. The entire spillway is set between two concrete abutment wing walls.

The visual inspection showed considerable variation from the plans. The left abutment wing wall is in satisfactory condition with minor spalling of the concrete. The crest of the spillway is flat with a length of about 30 feet set 1 foot lower than the remainder of the crest. The lower part has 1 foot high stoplogs installed to the level of the remainder of the spillway, and the remainder of the spillway crest has 2 rows of sandbags along its entire length. This effects an increase in the lake level of about 1 foot. During the inspection, water was spilling only over the stop logged crest. The upstream face of the spillway is silted almost up to the top of the concrete crest.

The downstream sloping face of the concrete spillway shows considerable spalling with exposed aggregate. The concrete appears to have been poured directly on the rock surface and there is moderate undermining evident. There is a large gouge running lengthwise about 3 feet below the crest, with the concrete being in better condition above the gouge than below it. It appears as though repairs have been made to the original spillway crest.

Flow from the spillway discharges into a wide ledge rock channel; a portion of the rock surface is concreted to provide a smoother surface and to close the rock seams. Numerous trees and brush are now growing in this channel and are rooted in the seams of the rock. The channel drops off rapidly and in parts very abruptly into an area filled with loose rock and boulders, which serves as an energy dissipator. The entire outlet channel turns to the left and runs roughly parallel to the downstream toe of the embankment until it joins the channel of Quassaick Creek.

d. Outlet Works - Flow from the two 30-inch outlet pipes, adjacent to the spillway, is discharged into the spillway outlet channel. The 30-inch gate valves are contained in a brick and concrete gatehouse built integrally to the spillway left abutment wing wall. The gatehouse is in satisfactory condition. The two manually operated gate valves are operated about twice a year to insure their operating condition.

The gate valve for the 36-inch outlet pipe is located in a brick and concrete gatehouse at the downstream toe of the embankment. According to the water plant superintendent, this pipe is seldom used to

release water for water supply because of the poor quality of the water drawn from the bottom of the lake. The 30-inch gate valve is operated about twice a year to insure its operating condition. The full capacity of this pipe could not be used to drain the lake without first removing the blind flange now in place on its outlet.

The new intake tower and discharge pump installation is in good condition and is operating satisfactorily to provide water to the filter plant.

e. Lake Area - The natural valley walls surrounding the lake have moderate slopes and are well covered with trees and brush. Some of the surrounding area is used as a recreational area under control of the City of Newburgh.

f. Downstream Channel - The channel of Quassaick Creek follows an irregular path downstream of Chadwick Lake, passing through Gardnertown, Glenwood Park and four small lakes before joining the Hudson River at the south boundary of the City of Newburgh. The water filtration plant is located immediately downstream of Chadwick Lake Dam at a bend in Quassaick Creek and is located at a potentially vulnerable location, since it presents a probable constriction to flood flows in the creek.

SECTION 3 - HYDROLOGY AND HYDRAULICS

The design flood used for Chadwick Lake Dam is the Probable Maximum Flood (PMF) according to the Recommended Guidelines for Safety Inspection of Dams. The PMF was calculated from the 6 hour Probable Maximum Precipitation, using a loss rate of .1 inches per hour. The flood hydrograph was developed from the Snyder unit hydrograph using average coefficients. Flood routing was performed assuming the two 30 inch diameter discharge pipes closed. The peak inflow and outflow rates were calculated as 15,500 cfs and 15,100 cfs respectively. The outflow peak would overtop the embankment by approximately 2.6 feet. Peak inflow and outflow rates for one-half of the PMF were calculated as 7,750 cfs and 7,150 cfs respectively. The spillway capacity of about 4,800 cfs corresponds to the outflow related to 36 per cent of the PMF. Therefore, the spillway is seriously inadequate, as cited by ETL 1110-2-234.

Drawdown analysis was performed assuming inflow equals 2 cfs per square mile of drainage area. The time required to drawdown the reservoir to elevation 439 is approximately 17 days.

SECTION 4 - STRUCTURAL STABILITY

4.1 VISUAL OBSERVATIONS AND DATA REVIEWS

No design calculations were available for review. The composition and characteristics of the material used in the earth embankment are not known.

A stability analysis was made for the concrete spillway structure at its maximum cross-section, using dimensions as given in the existing plans, modified based on the visual inspection. Factual data pertaining to foundation conditions are not available. The rolled earth embankment on the upstream face of the spillway was assumed to reduce the uplift at the heel to 50 per cent of headwater pressure. Therefore, design assumptions concerning foundation rock characteristics were based on information obtained from "Application for the Construction or Reconstruction of a Dam" data and field observations made during the course of the inspection.

This stability analysis (see Appendix) indicates the spillway structure to be stable for normal pool and earthquake loadings. Tension was found to develop in the heel of the spillway for the condition of headwater at the top of embankment. For the ice loading condition, overturning instability is indicated.

<u>Loading Condition</u>	<u>Factors of Safety</u> ¹		<u>Foundation Pressures(psi)</u> ²	
	<u>Overturning</u>	<u>Sliding</u>	<u>Heel</u>	<u>Toe</u>
Normal Pool	2.35	14.1	10.2	3.8
Earthquake	2.22	13.2	11.0	3.0
Reservoir @ Top of Dam	1.28	10.2	14.6	-3.8
Ice Load (5 kips)	.97	7.8	29.2	-15.1

Notes:

- 1) Sliding includes 50 psi shear
- 2) Negative indicates tension

4.2 GEOLOGY AND SEISMIC STABILITY

Chadwick Lake Dam is located on Quassaick Creek in the Hudson-Mohawk Lowlands physiographic province, a lowland underlain by Ordovician shales and containing gently rounded hills in a broad valley. The dam and reservoir rests on gently dipping black shales of the Trenton group, described in the geologic map of New York (Lower Hudson Sheet)

as the Snake Hill Shale. Shale bedrock forms the foundation of the dam and, according to design data, lies a few feet below ground surface.

The immediate area does not contain any notable faults or rock weaknesses; however, the Ramapo fault extends into the area several miles to the southeast of the dam. Recent recorded seismic activity along the fault has been noted; this seismic activity should pose no problems to the stability of the dam as located within Seismic Risk Zone 1 of the Seismic Zone Map of Contiguous States. It appears that static stability calculations are satisfactory for design.

SECTION 5 - ASSESSMENT/REMEDIAL MEASURES

5.1 ASSESSMENT

The riprap on the upstream slope of the earth embankment appears to have been adequate to provide protection against erosion and wave action. The appurtenant structures associated with the various outlet works appear to be in satisfactory condition and should not adversely affect the safety of the embankment.

The presence of large trees on the embankment represents a potential hazard: the trees could be uprooted during severe storms, and the root systems may provide seepage paths that could lead to future piping problems.

The outlet pipes are not provided with upstream flow control. The pipes are always under pressure. Uncontrolled leakage from the pipes could cause piping through the embankment. In addition, there is no available means of providing maintenance on the existing controls.

5.2 REMEDIAL MEASURES

1) All trees on the embankment should be cut off as near the embankment surface as practicable. A further investigation should be made to determine the extent of the root systems before remedial measures can be recommended.

2) All brush should be removed from the downstream slope of the embankment so that periodic inspections can be made to detect seepage or monitor the embankment.

3) The spillway should be strengthened to provide adequate factors of safety for all loading conditions. The downstream face of the spillway structure should be given a concrete coating to seal and repair the surface. This coating should also be placed so as to seal the base of the structure to the underlying rock and prevent further undermining.

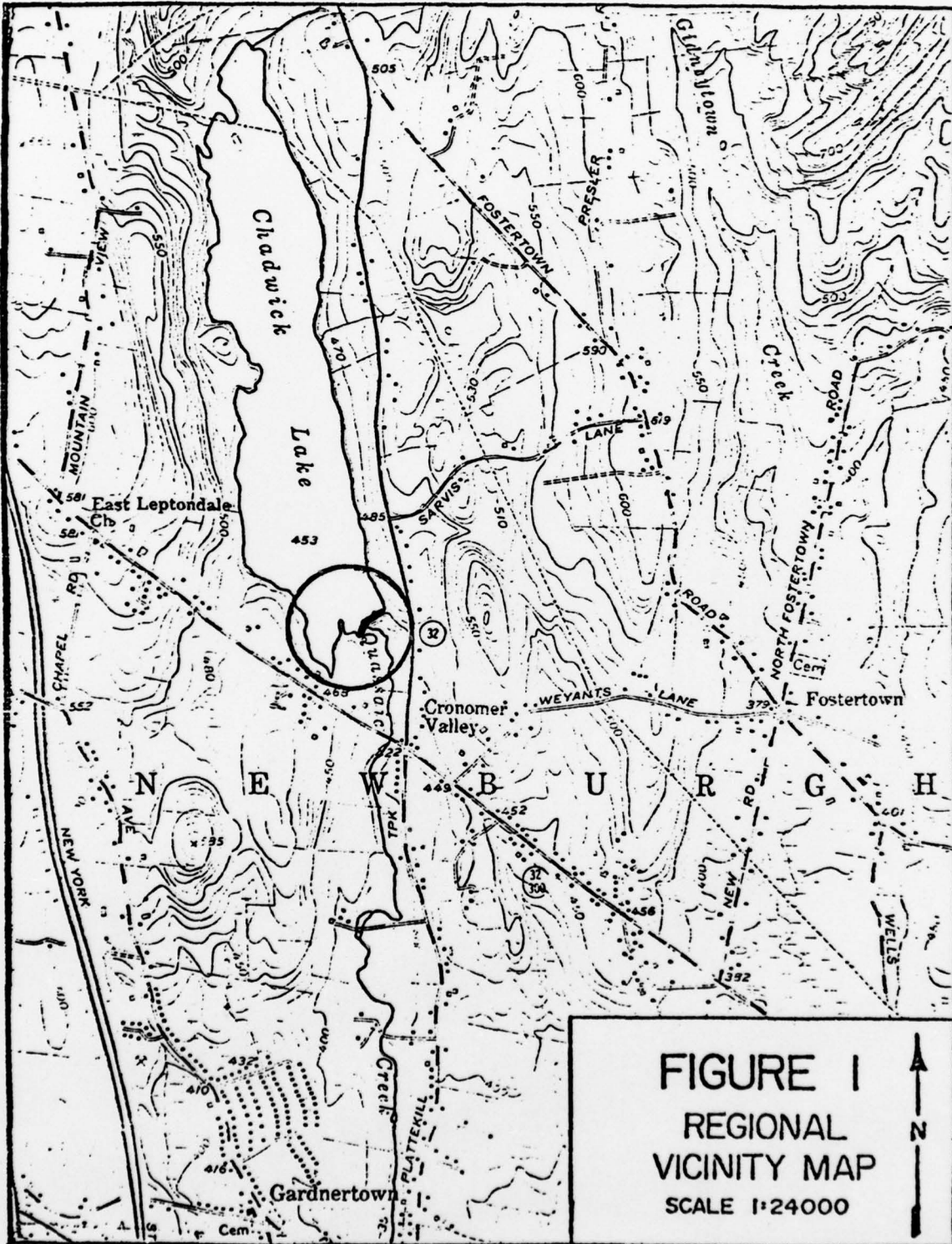
4) The spillway outlet channel should be cleared of all trees, brush and debris to provide unimpeded flow over the rock channel. Open seams in the rock bed of the channel immediately below the spillway should be sealed with grout or gunite to minimize ice and freezing damage, and prevent further plant growth.

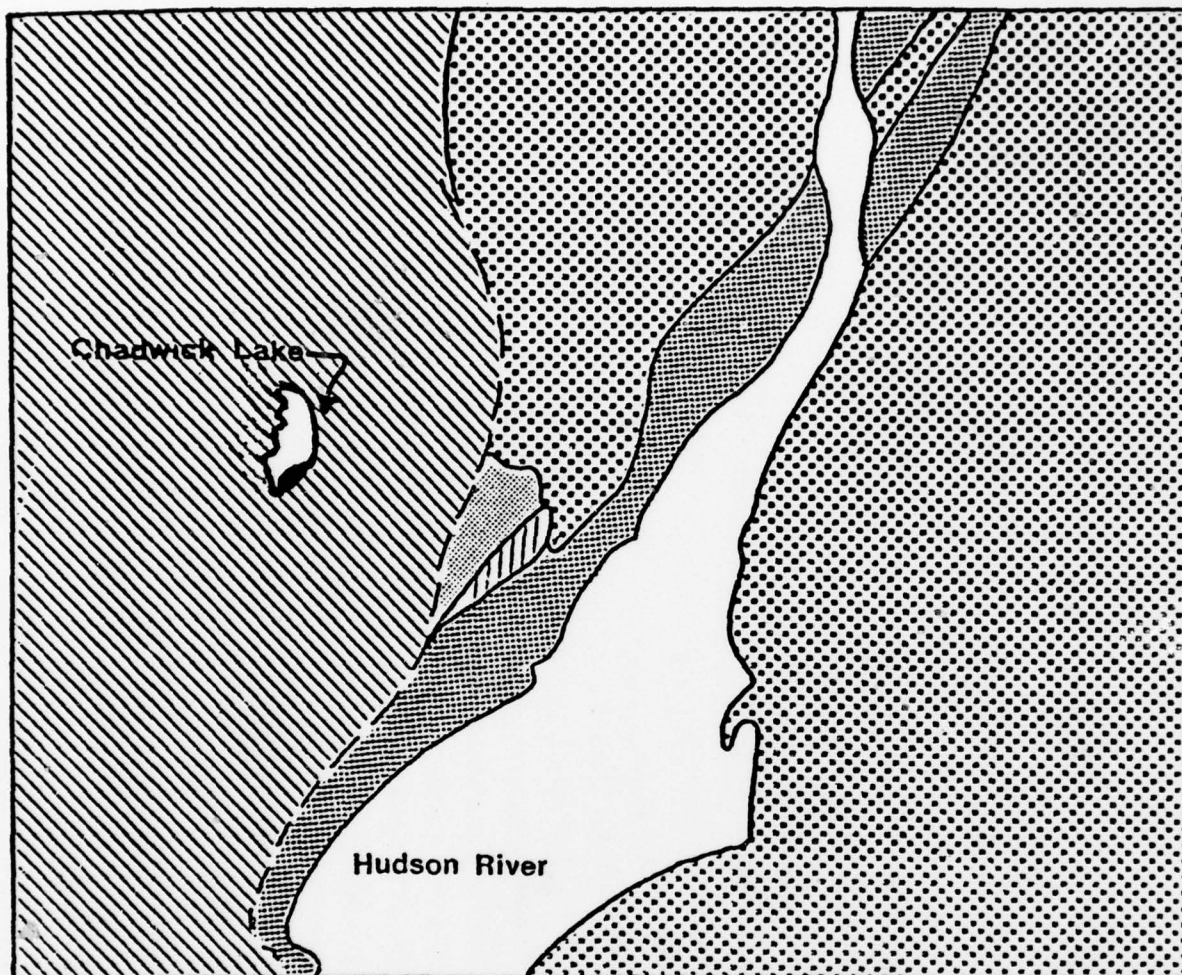
5) Silt should be removed from upstream of the spillway to a depth of 3 feet or more to discourage plant growth which will impede flow over the spillway.

6) Since the spillway has been classed as seriously inadequate, arrangements should be made to provide around-the-clock surveillance of the dam and spillway during periods of unusually heavy rainfall in the drainage basin of the lake. A warning system should be established to provide warning to residents and businesses downstream of the dam in sufficient time to prevent loss of life and to minimize property damage.

7) Consideration should be given to upstream control for the outlet pipes for safety and ease of maintenance.

FIGURES





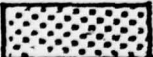




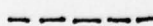
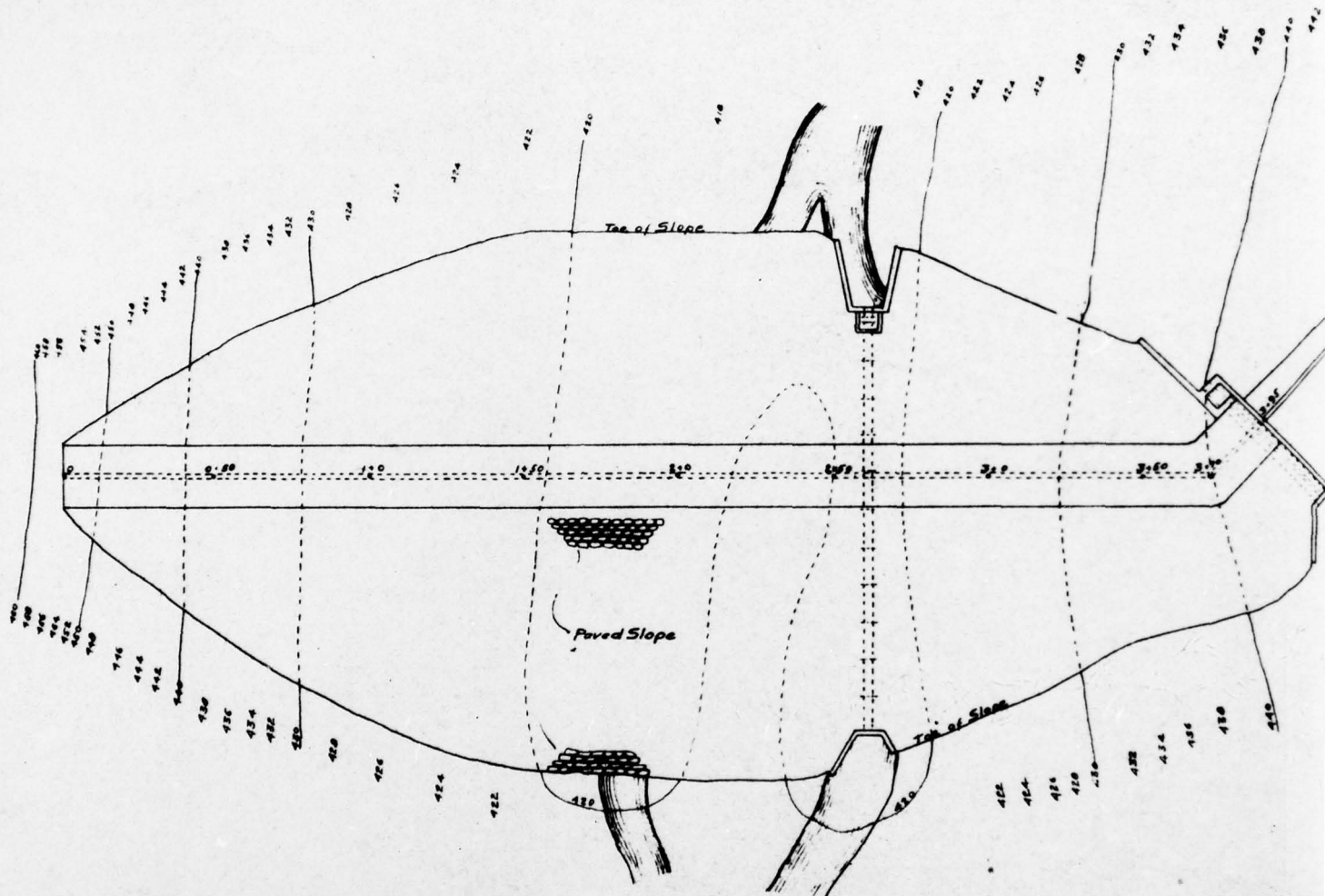
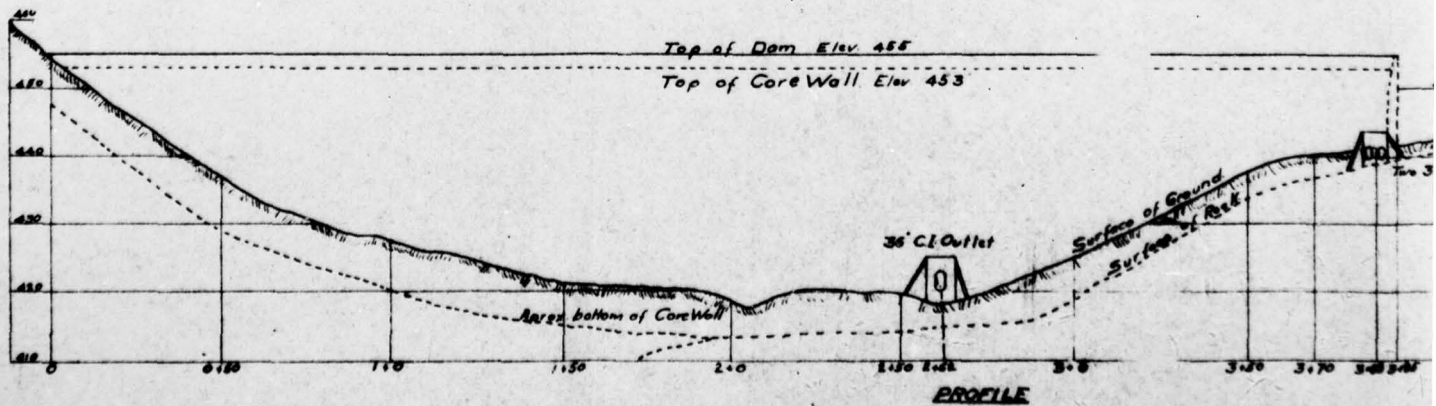
-  On- black and grey shale
-  Osh-Stoney Point Shale
-  Epg - Poughquag orthoquartzite
-  OEs - undifferentiated carbonates
-  qtcs - non-rusty paragneiss
-  Raritan Fault

FIGURE 2
GEOLOGIC MAP



PLAN



PROFILE

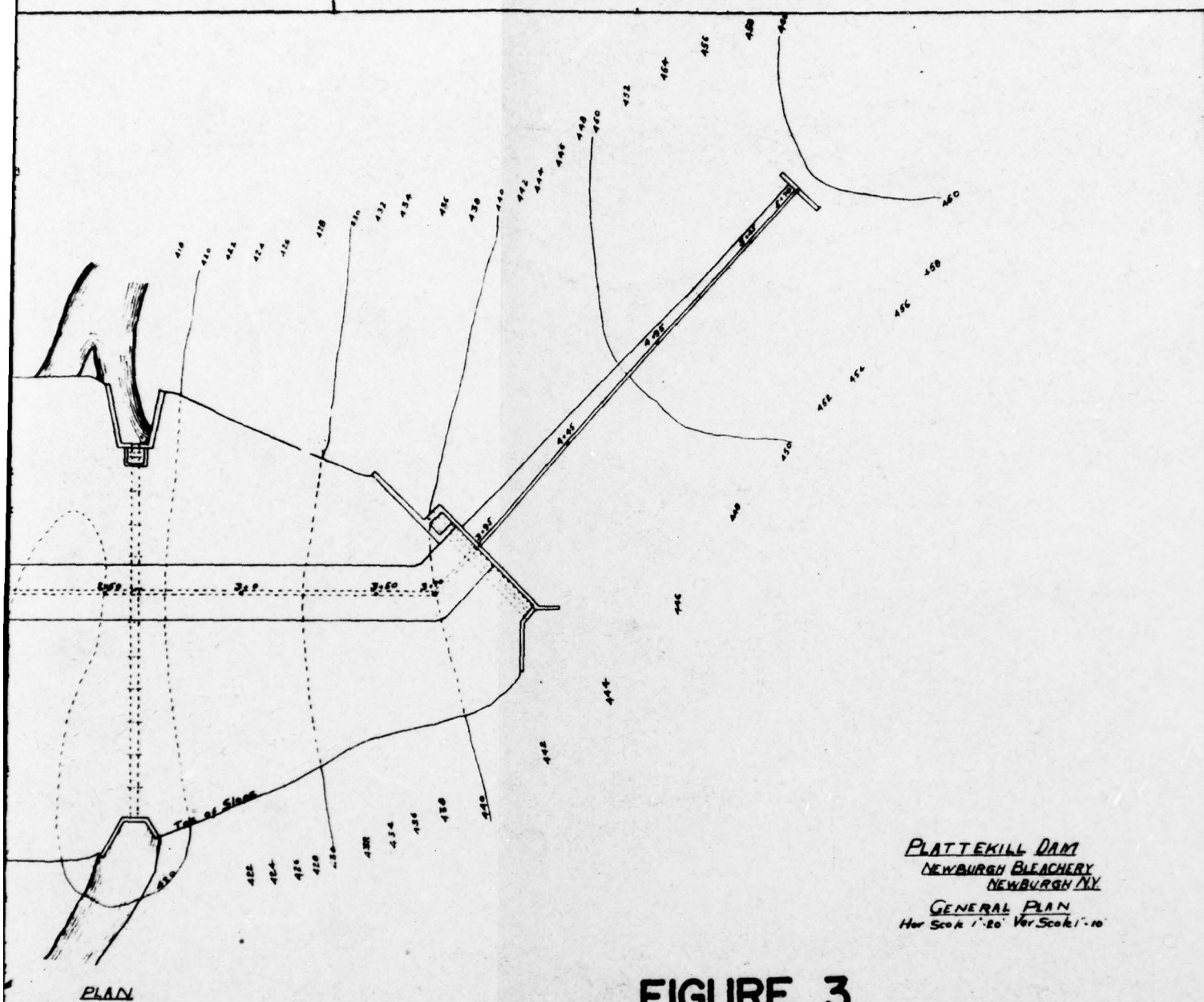
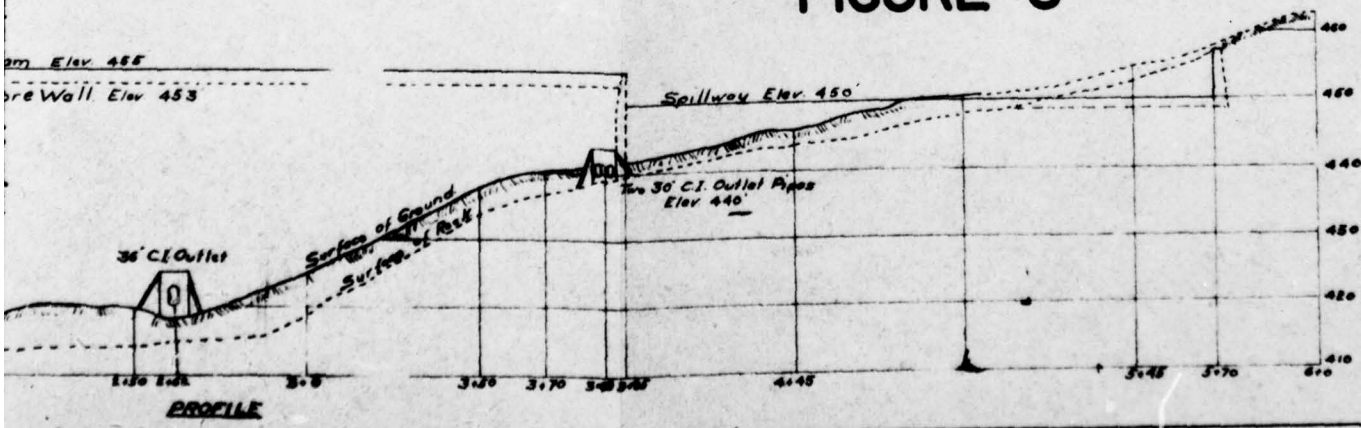
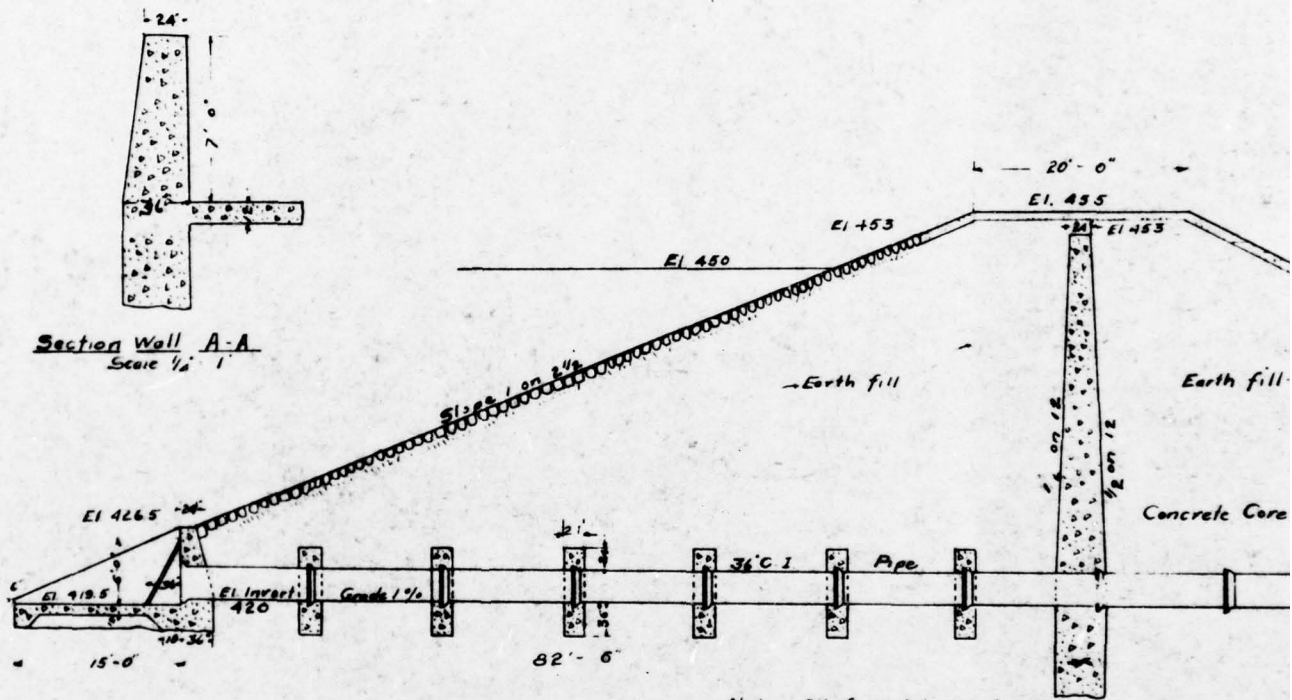


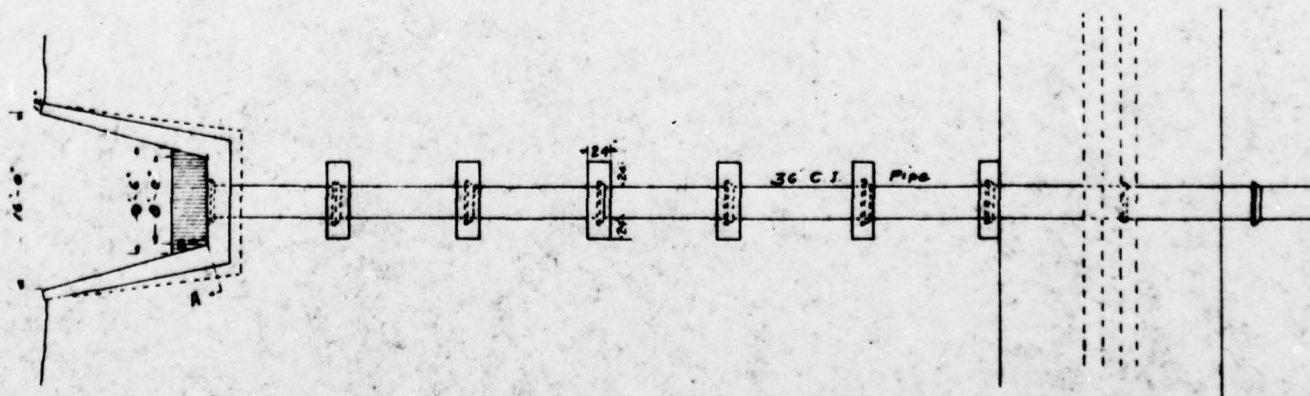
FIGURE 3

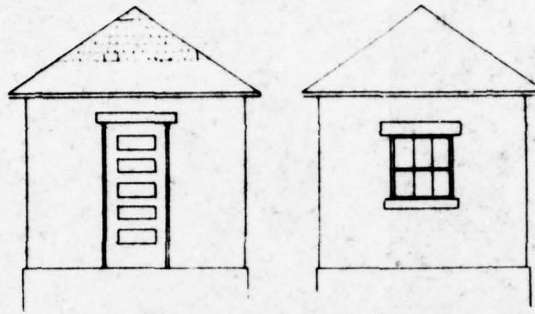




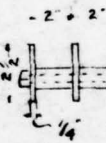
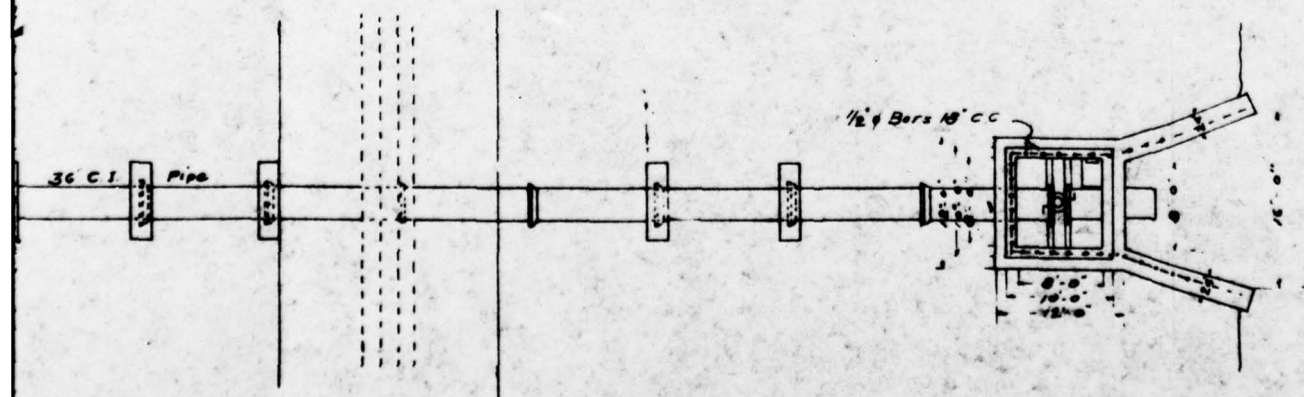
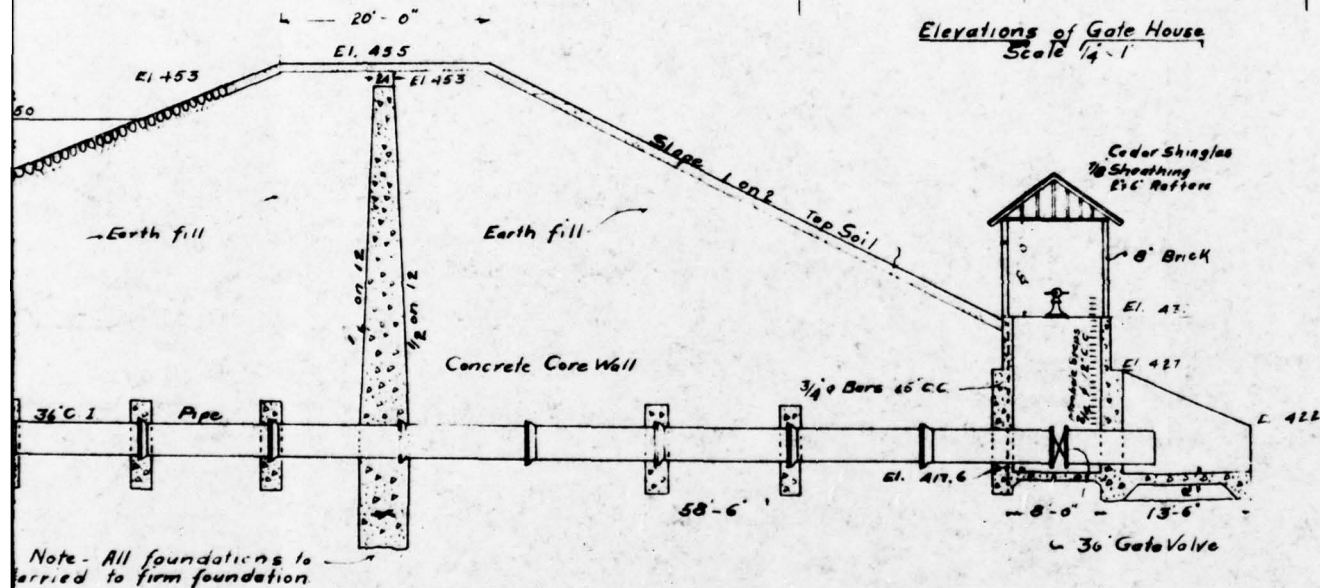
Note - All foundations to be carried to firm foundation.

SECTION Sta. 2+62



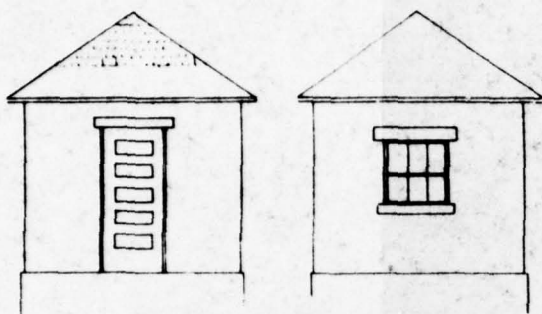


Elevations of Gate House
Scale 1/4" = 1'

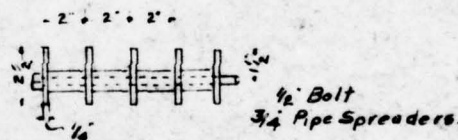
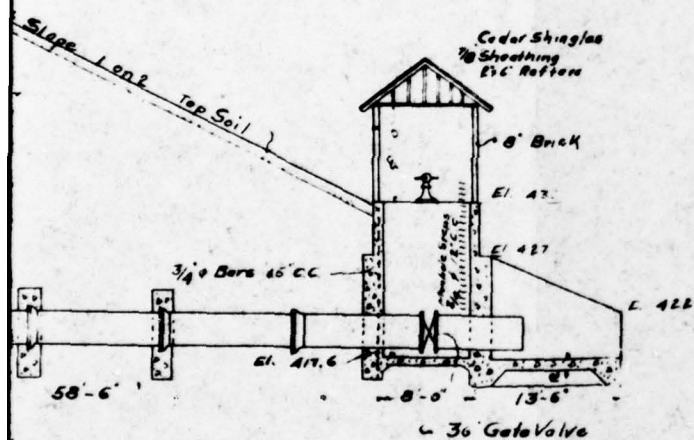


Detail
Scale

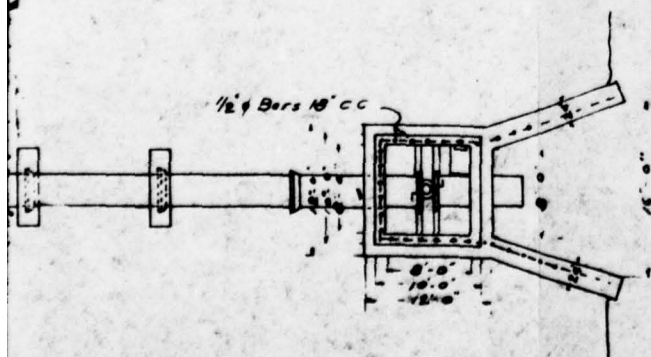
FIGURE



Elevations of Gate House
Scale $\frac{1}{4}'' = 1'$



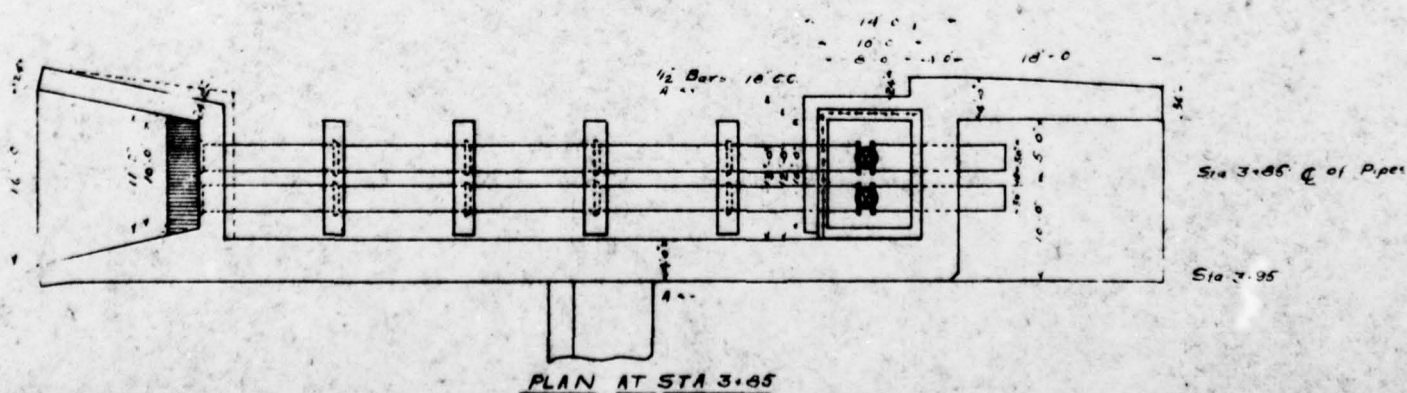
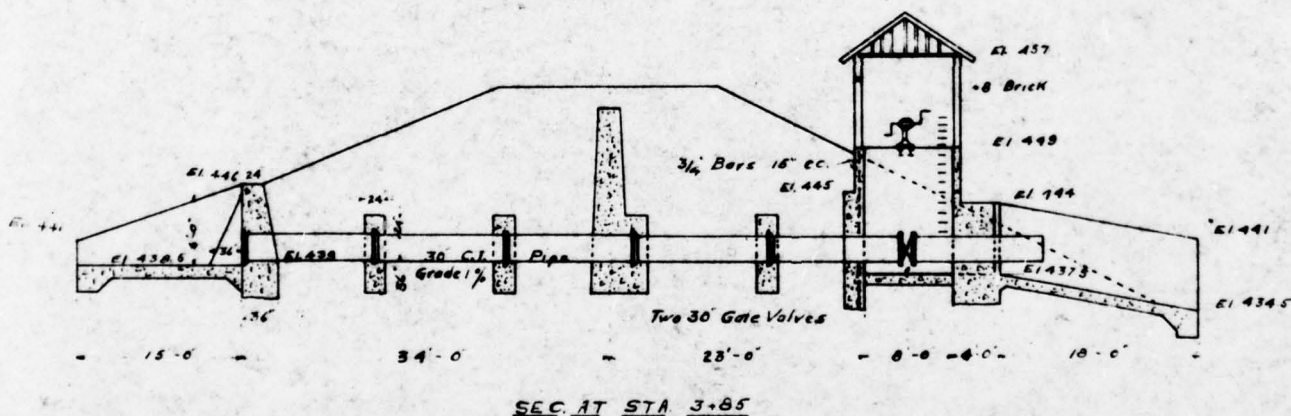
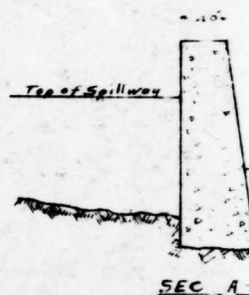
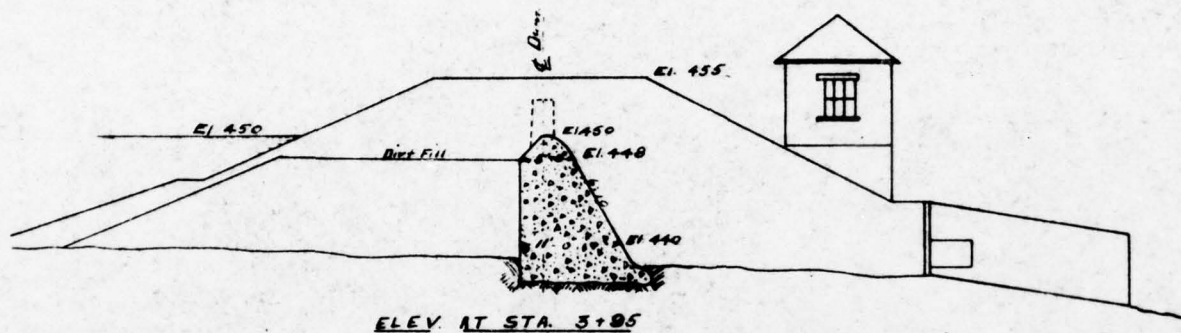
Details of Trash Rack
Scales $\frac{1}{4}''$ and $8'' = 1'$

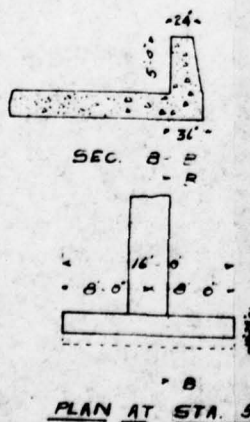
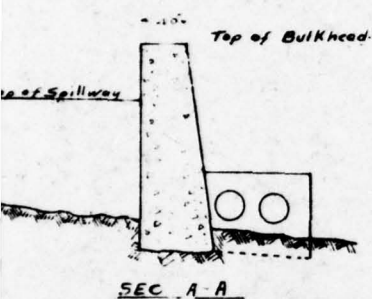


PLATTEKILL DAM
NEWBURGH BLEACHERY
NEWBURGH NY

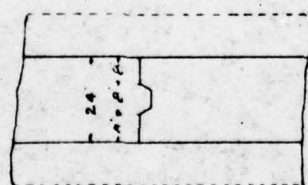
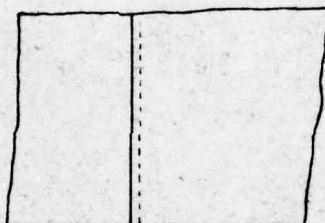
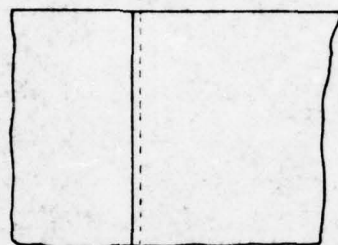
Details of Outlet Pipe
Scale $\frac{1}{8}'' = 1'$

FIGURE 4





PLAN AT STA. 5+70



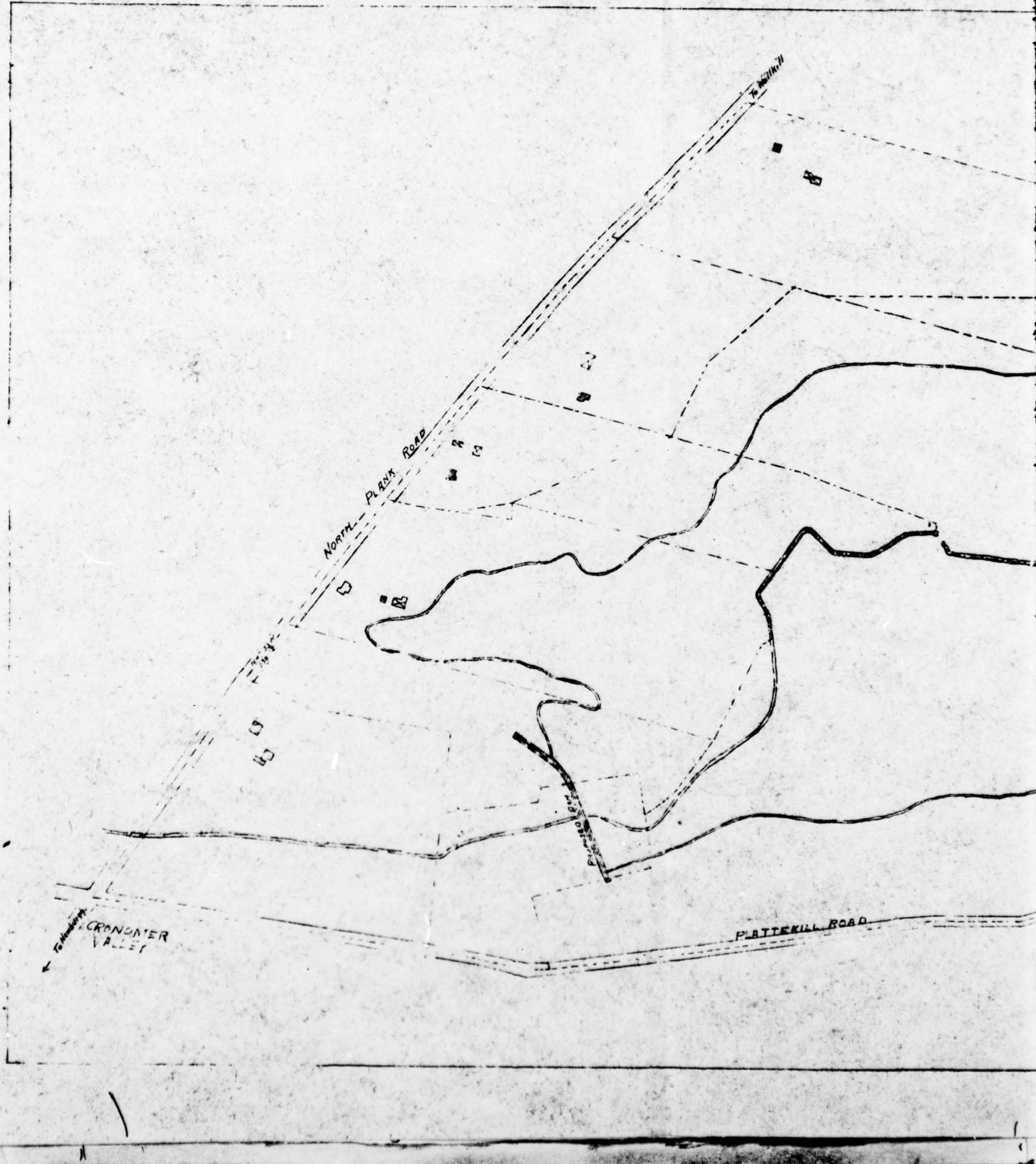
Scale 1/2" = 1'

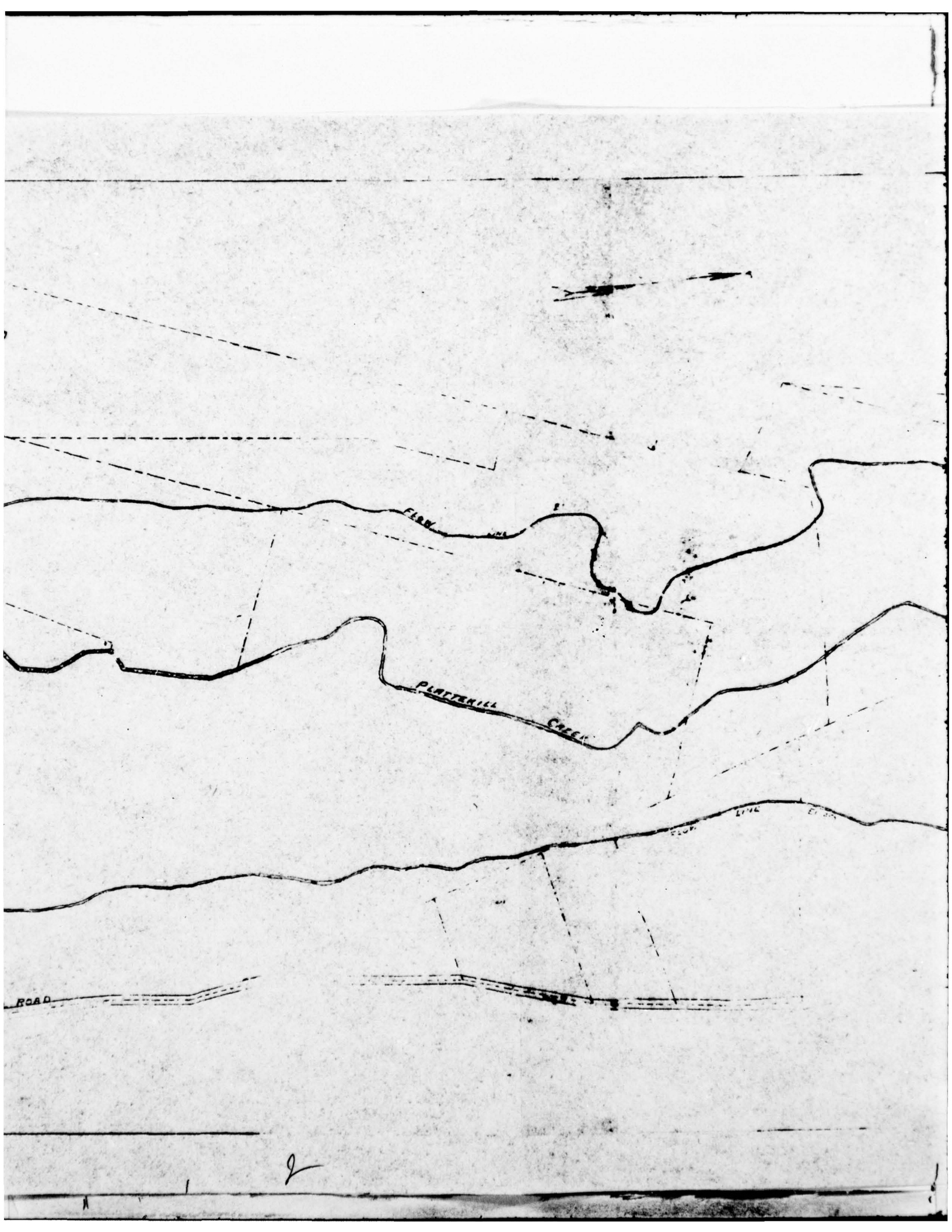
Note All walls to have expansion joints at least every 50 ft also where core wall and spillway sections join on bulkhead section. All joints to be coated with Asphaltic Joint Compound.

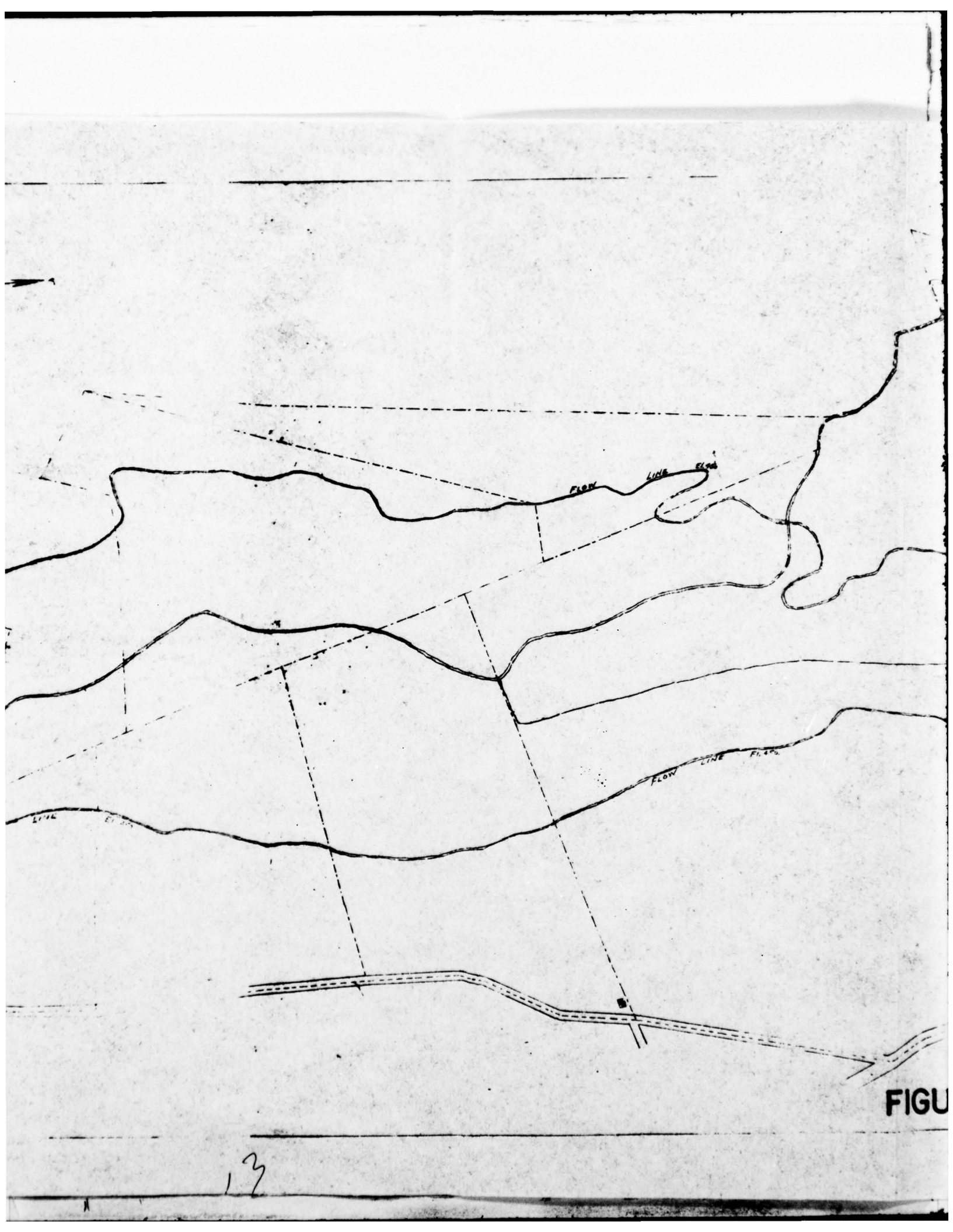
PLATTEKILL DAM
NEWBURGH BLEACHERY
NEWBURGH N.Y.

PLANS AND SEC DISCHARGE PIPE
Scale 1/8" = 1'

FIGURE 5







FIGU

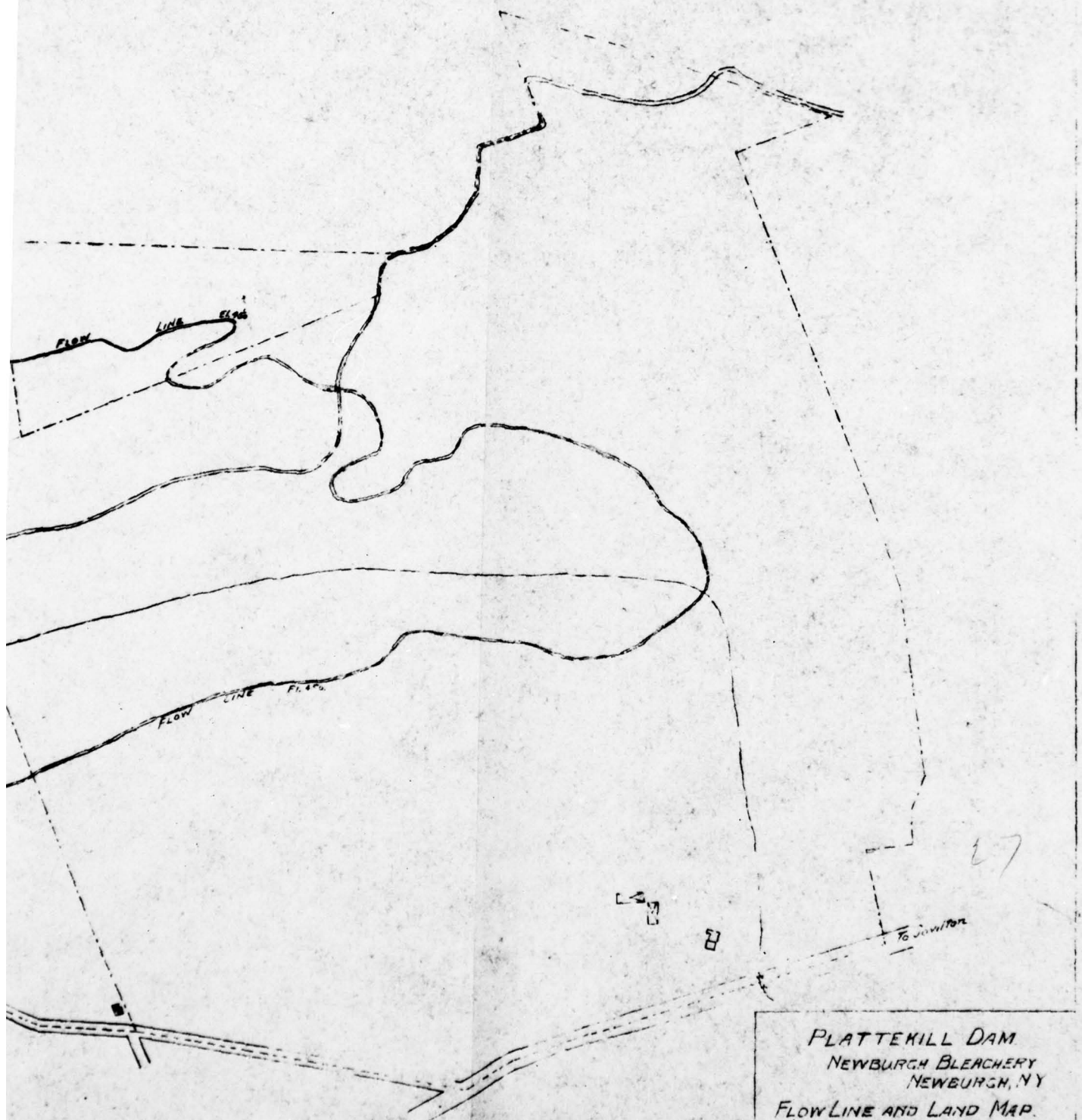


FIGURE 6

PLATTEKILL DAM
NEWBURGH BLEACHERY
NEWBURGH, NY
FLOW LINE AND LAND MAP.
Scale 1" = 200'

APPENDIX

FIELD INSPECTION
REPORT

Check List
Visual Inspection
Phase 1

Name Dam Chadwick Lake Dam County Orange State New York Coordinators _____

Date(s) Inspection June 26, 1978 Weather Partly Cloudy Temperature 72° F

Pool Elevation at Time of Inspection 451.0⁺ M.S.L. Tailwater at Time of Inspection ----- M.S.L.

Inspection Personnel:

Mr. George C. Elias _____

Mr. James Ryan _____

Mr. Francis E. Falcone _____

Mr. Charles A. Richardson _____

Mr. James Ryan _____ Recorder

Accompanied by:

Mr. Jess Haffen, Plant Superintendent, Chadwick Lake Filter Plant, City of Newburgh, New York.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
UPSTREAM SLOPE	Trees and brush above riprap.	Clear all trees and brush. Do not remove tree root system.
DOWNSTREAM SLOPE	Heavy brush, large trees, wooded.	
FUNCTION OF EMBANKMENT AND ADJUTANT, SPILLWAY AND DAM	In good condition at all junctions.	None.
ANY NOTICEABLE SEEPAGE	Not observable.	Brush and trees should be removed and periodic inspection made.
STAFF GAGE AND RECORDER	None.	Not essential, but would be good to monitor changes in lake level.
DRAINS	None observed from embankment.	None.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	None.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.	None.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No settlement observed.	None.
RIPRAP FAILURES	None observed.	None.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Spalling and exposure of aggregate. Erosion at base.	Gunite surface repairs and sealing of base.
APPROACH CHANNEL	Filled with silt almost to weir elevation. Plant growth in approach.	Remove silt to a depth to discourage plant growth.
DISCHARGE CHANNEL	Numerous trees, brush and debris.	Should be cleared to provide free flow.
BRIDGE AND PIERS	None.	None.

RESERVOIR

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

SLOPES

Moderate slopes, well wooded.

None.

SEDIMENTATION

Very little observed except in
spillway area.

None.

INSTRUMENTATION

VISUAL EXAMINATION MONUMENTATION/SURVEYS	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	None.	None needed.
OBSERVATION WELLS	None.	None needed.
WEIRS	None.	None needed.
PIEZOMETERS	None.	None needed.
OTHER	None.	None.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None. Outlet pipes are cast iron.	None.
INTAKE STRUCTURE	Concrete inlet structures not observable. Water supply intake structure in very good condition.	None.
OUTLET STRUCTURE	Concrete in good condition.	None.
OUTLET CHANNEL	Natural channel only.	None.
EMERGENCY GATE	None.	None.

DOWNSTREAM CHANNEL

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

CONDITION
(OBSTRUCTIONS,
DEBRIS, ETC.)

Considerable debris and trees
immediately below dam.

Should be cleared to provide
free flow.

SLOPES

APPROXIMATE NO.
OF HOMES AND
POPULATION

ITEM

REMARKS

DESIGN REPORTS

None available.

GEOLOGY REPORTS

Only in application for construction.

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

None available.

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

Laboratory report on sand and cement tests.

POST-CONSTRUCTION SURVEYS OF DAM

Dam Inspection Report, 9/18/74.

BORROW SOURCES.

Unknown.

REMARKS

ITEM

MONITORING SYSTEMS

None.

MODIFICATIONS

Possibly to spillway crest.

HIGH POOL RECORDS

None.

POST CONSTRUCTION ENGINEERING
STUDIES AND REPORTS

None.

PRIOR ACCIDENTS OR FAILURE OF DAM
DESCRIPTION
REPORTS

None.

MAINTENANCE
OPERATION
RECORDS

None.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Plan filed with NYDEC. See figs.
REGIONAL VICINITY MAP	None.
CONSTRUCTION HISTORY	Unknown.
TYPICAL SECTIONS OF DAM	Plans filed with NYDEC. See figs.
HYDROLOGIC/HYDRAULIC DATA	Filed with NYDEC - Application for Construction Storage given as 800,000,000 gallons and 18,365 acre-feet. Believe acre-feet should be 2,450.
OUTLETS - PLAN	Plans filed with NYDEC.
- DETAILS	See figs.
- CONSTRAINTS	
- DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	Rainfall records (before construction) filed with NYDEC.

ITEM

REMARKS

SPILLWAY PLAN

SECTIONS

DETAILS

Plans filed with NYDEC.
See figs.

OPERATING EQUIPMENT
PLANS & DETAILS

Plans filed with NYDEC.
See figs.

PHOTOGRAPHS



VIEW ALONG SPILLWAY CREST



DOWNSTREAM FACE OF SPILLWAY SHOWING
SPALLING AND UNDERMINING



SPILLWAY OUTLET CHANNEL ABOVE DROP-OFF



SPILLWAY OUTLET CHANNEL DOWNSTREAM

HYDROLOGIC/HYDRAULIC CALCULATIONS

SUBJECT	SHEET	BY	DATE	JOB NO
CHADWICK LAKE DAM	1	CAR	7/5/78	1467.021.1.

Checked DBC

PMP COMPUTATIONS

DRAINAGE AREA = 13.5 sq. mi. From USGS Quad's & application data.

PMP - 6 Hr. duration 10 sq. mi., Zone 1
= 24"

Isohyetal "fit" reduction factor = 19.56%

Depth - Area - Duration adjustment = 97% (0-6 Hrs.)
108% (0-12 Hrs.)
117% (0-24 Hrs.)
124% (0-48 Hrs.)

Duration, hours	% Adjustment	Total PMP, inches
0-6	97	23.3
0-12	108	25.9
0-24	117	28.1
0-48	124	29.8

Adjusted 6 Hr. PMP = $23.3 - 23.3(19.56\%) = 18.7''$

12 Hr. PMP = $25.9 - 25.9(19.56\%) = 20.8''$

SECOND SIX HOURS

2.1"

SUBJECT	SHEET	BY	DATE	JOB NO.
CHADWICK LAKE DAM	2	FEF	7/30/78	1467-021-1/1

Checked DBC

Hourly PMP

Time (Hrs.)	E PMP	Incr. PMP	Distribution
1.0	9.35	9.35	.25
2.0	12.16	2.81	.25
3.0	14.03	1.87	.45
4.0	15.90	1.87	.45
5.0	17.39	1.49	1.31
6.0	18.70	1.31	1.49
7.0	19.15	.45	2.81
8.0	19.60	.45	9.35
9.0	19.95	.35	1.87
10.0	20.30	.35	1.87
11.0	20.55	.25	.35
12.0	20.80	.25	.35

$$C_t = 2.0 \quad C_p = .625$$

$$T_p = 2 \times (L \times L_{ca})^{.3} \quad \text{if } L = 10 \text{ miles} \quad L_{ca} = 4.5 \text{ miles}$$

$$T_p = 6.27 \text{ hrs.}$$

$$t_R = T_p / 5.5 = 1 \text{ hr.}$$



JUSTIN & COURTNEY
DIVISION OF O'BRIEN & GERE ENGINEERS

SUBJECT

CHADWICK LAKE DAM

SHEET

BY

DBC

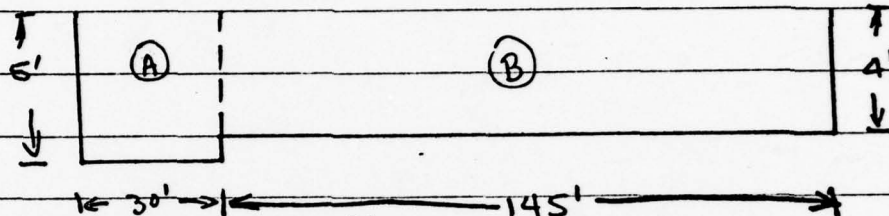
DATE

8/23/78

JOB NO

Checked R&H

SPILLWAY DISCHARGE



$$Q_{OT} = 3.1 \times 400 \times (H-5)^{3/2}$$

$$Q_A = 3.2 \times 30 \times H^{3/2}$$

$$Q_B = 3.2 \times 145 \times (H-1)^{3/2}$$

Elev.	H	Q _A	Q _B	Q _{OT}	ΣQ
450	0	0	0	0	0
451	1	96	0	0	96
452	2	272	464	0	736
453	3	499	1312	0	1811
454	4	768	2411	0	3179
455	5	1073	3712	0	4785
456	6	1411	5188	1240	7839
457	7	1778	6819	3507	12104
458	8	2172	8593	6443	17208
459	9	2592	10499	9920	23011

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Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. _____ OF _____

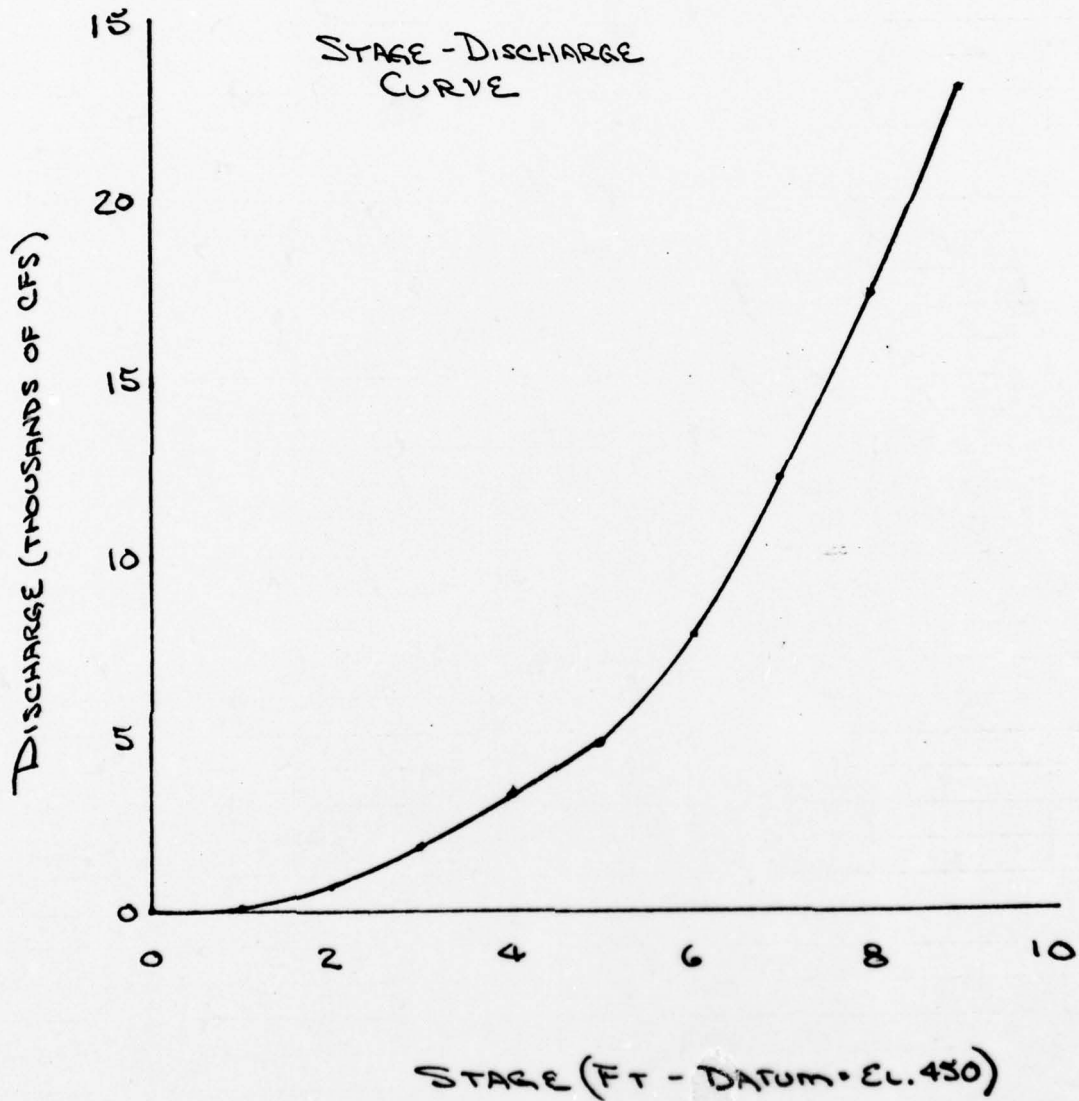
DATE 8/23/78

NAME OF CLIENT NYDEC

COMP. BY DBC

PROJECT Chadwick Lake

CHECKED BY REH



SUBJECT	SHEET	BY	DATE	JOB NO.
CHADWICK LAKE DAM		DBC	8/23/10	

checked REH

STAGE - STORAGE

Area @ El. 450 \approx 260 acres

Area @ El. 455 \approx 278 acres

$$A = 3.6H + 260$$

$$\oint \text{Surcharge Storage (S)} = \int A dH$$

$$\therefore S = 1.8H^2 + 260H$$

<u>Elev.</u>	<u>H</u>	<u>S</u>
450	0	0
451	1	262
452	2	527
453	3	796
454	4	1069
455	5	1345
456	6	1625
457	7	1908
458	8	2195
459	9	2486

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Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. _____ OF _____

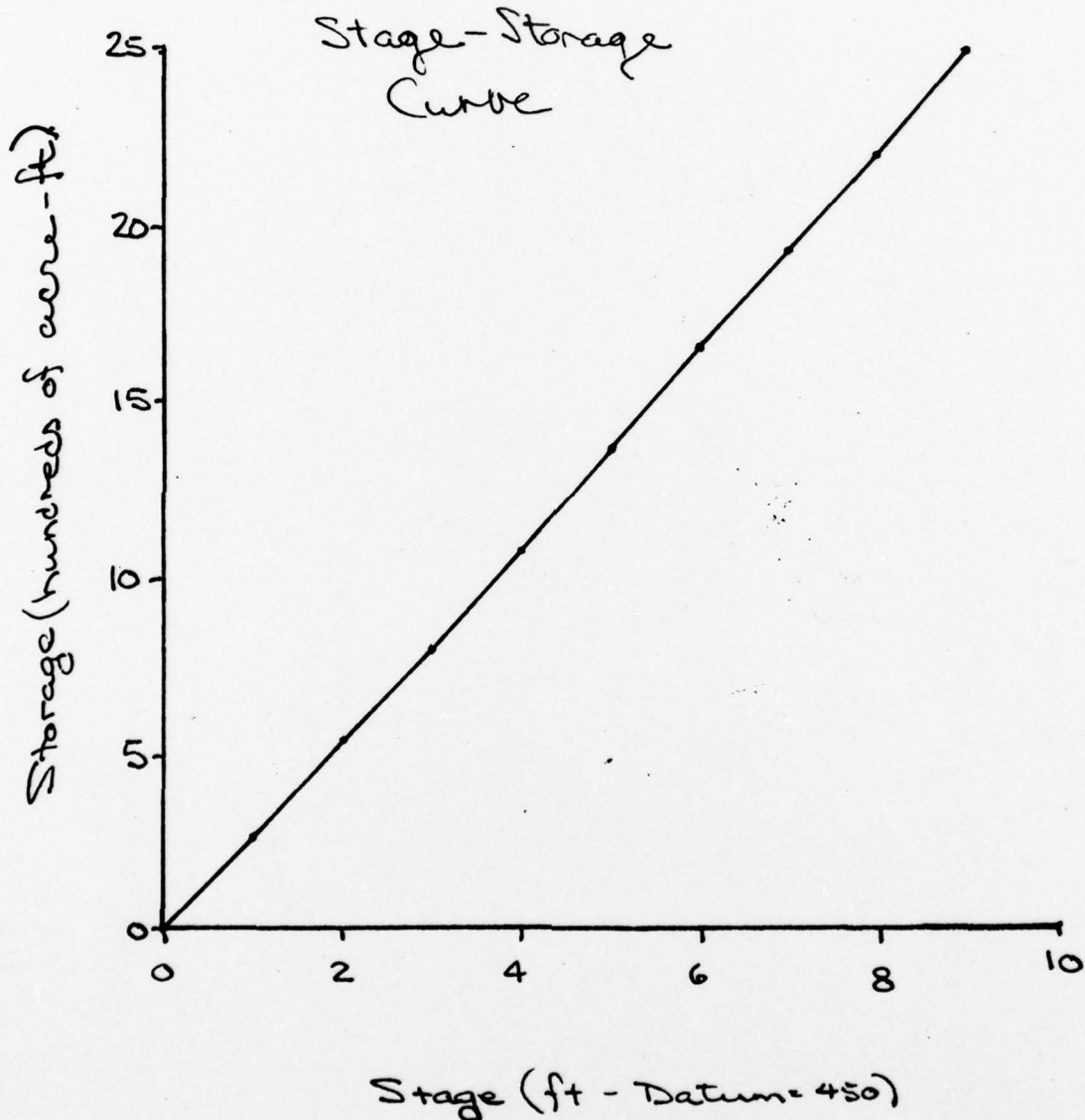
DATE 8/23/78

NAME OF CLIENT NYSDEC

COMP. BY DGE

PROJECT Chadwick Lake

CHECKED BY REH



JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. _____ OF _____

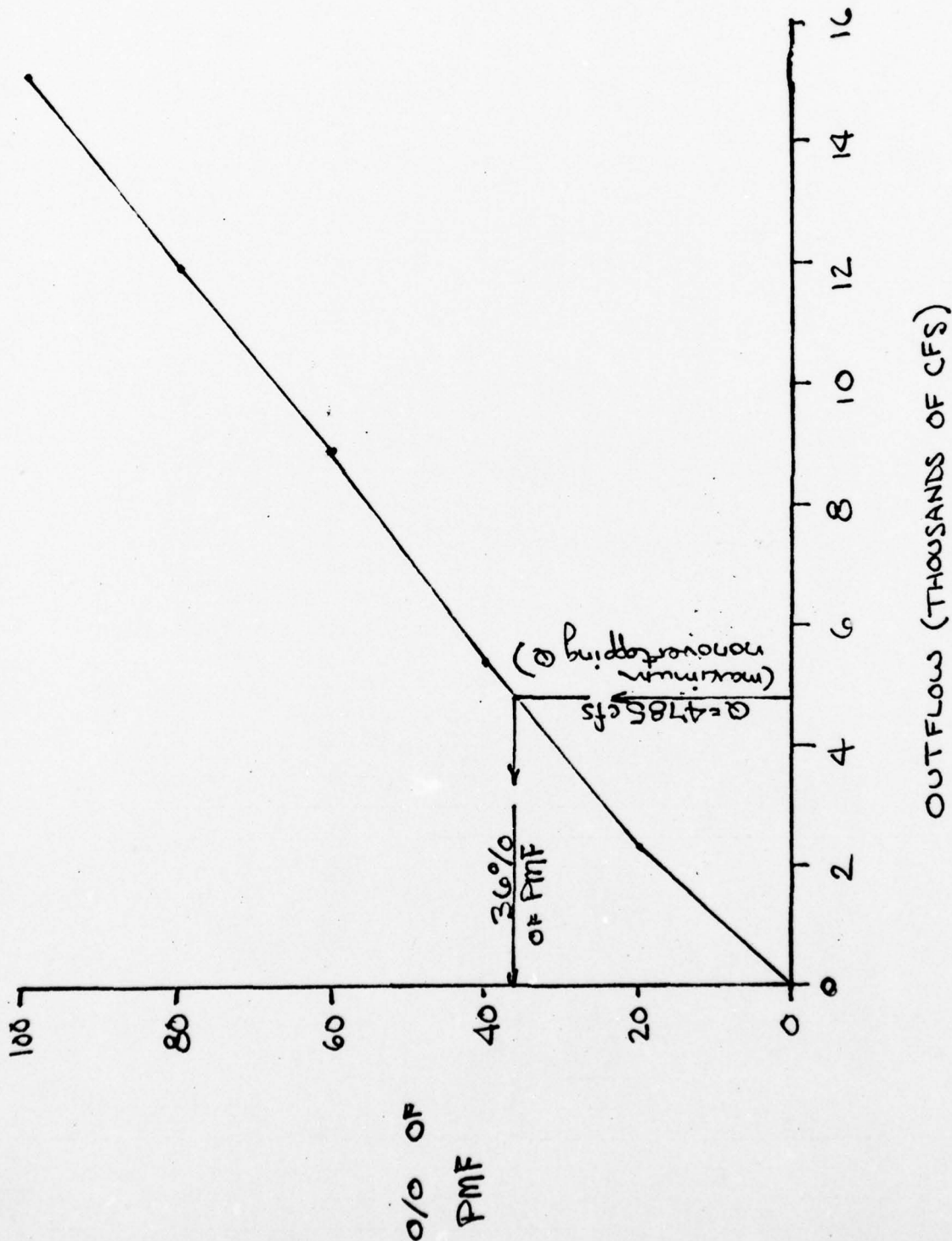
DATE 8/27/78

COMP. BY DBC

CHECKED BY REH

NAME OF CLIENT NYSDEC

PROJECT Chadwick Lake



SUBJECT	SHEET	BY	DATE	JOB NO.
CHADWICK LAKE DAM	7A	COA	7/17/78	1467.021.11

Checked DBE

DRAWDOWN TIME CALC.

Spillway Crest Elev. (Normal Pool) 450.0

Invert of 2-30" pipes 439.0

11.0' draw do

36" Pipe has blind flange on outlet.

Aver. discharge rate, 2-30" pipes = 104 cfs
to invert of pipe inlet.

Inflow = 2 cfs \times 13.5 sq. mi. = 27 cfs

Storage - Elev. 450 to Elev. 439.0

$$\frac{260 + 220}{2} \times 11 \times 43,560 = 1.15 \times 10^8 \text{ cf.}$$

Discharge Rate = $(104 - 27) \times 3600 = 27.72 \times 10^4 \text{ c.f./hr.}$

Drawdown Time = $\frac{1.15 \times 10^8}{27.72 \times 10^4} = 415 \text{ Hrs.} = \underline{17.3} \text{ days.}$

Does not include drawdown below
Elev. 439.0

HEC-1 VERSION DATED JAN-1973
UPDATED AUG 74
CHANGE NO. 01

CHADWICK LAKE DAM
PMF HYDROLOGY
NATIONAL DAM INSPECTION PROGRAM

JOB SPECIFICATION
NQ NHR NMIN IDAY IHR TMIN METRC IPLET IPPT NSTAN
50 1 0 1 0 0 0 0 0 0 0
JOPER NWT
5 0

MULTI-PLAN ANALYSIS TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1
RTIOS= .20 .40 .60 .80 1.00

SUB-AREA RUNOFF COMPUTATION
ISTAQ ICOMP IEGON ITAPE JPLT JPPT INAME
1 0 0 0 0 0 0

HYDROGRAPH DATA
IHYG IJMG TAREA SNAP TRSDA TPSPC PATIO ISNOW ISAME LOCAL
0 1 13.50 0.00 0.00 0.00 0.00 0.000 0 0 0

PRECIP DATA
NP STORM DAJ DAK
12 0.00 0.00 0.00
PRECIP PATTERN
.25 .45 .45 1.31 1.49 2.81 9.35 1.87 1.87
.35

LOSS DATA
STKR2 DLTKR RTIOL ERAIN STRKS RTIOK STRIL CNSTL ALSXK RTIMP
0.00 0.00 1.00 0.00 0.00 1.00 0.00 .10 0.00 0.00

UNIT HYDROGRAPH DATA
TP= 5.27 CP= .63 NTA= 0

RECESSION DATA
SIPTO= 0.00 QPCSN= 0.00 RTIOR= 1.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE IC= 7.29 AND R= 5.66 INTERVALS

UNIT HYDROGRAPH 34 END-OF-PERIOD ORIGINATES, LAG= 6.25 HOURS, CP= .53 VOL= 1.00
51. 186. 369. 569. 744. 852. 813. 689. 577.
433. 405. 339. 284. 239. 199. 167. 140. 98.
82. 69. 58. 48. 34. 28. 24. 20. 17.
14. 12. 10. 8.

END-OF-PERIOD FLOW
TIME RAIN EXCS COMP 7

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

3.	14.	40.	90.	181.	346.	625.	1196.	2135.	3290.
4486.	5479.	6072.	6191.	5803.	5111.	4379.	3698.	3105.	2602.
2179.	1826.	1529.	1281.	1073.	899.	753.	630.	528.	442.
371.	310.	260.	218.	182.	152.	126.	105.	85.	67.
43.	15.	8.	2.	1.	0.	0.	0.	0.	0.

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
6191.	5323.	2721.	1359.	67935.
CFS	3.81	7.50	7.80	7.80
INCHES	2740.	5400.	5617.	5617.
AC-FT				

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

5.	21.	61.	134.	272.	519.	938.	1794.	3202.	4936.
6729.	8218.	9107.	9286.	8704.	7666.	6568.	5546.	4658.	3903.
3269.	2738.	2294.	1921.	1509.	1348.	1129.	946.	792.	654.
556.	466.	390.	327.	273.	228.	190.	157.	127.	100.
73.	23.	12.	3.	1.	0.	0.	0.	0.	0.

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
9296.	8285.	4082.	2039.	101902.
CFS	5.71	11.25	11.70	11.70
INCHES	4110.	8101.	8426.	8426.
AC-FT				

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 4

6.	28.	81.	179.	362.	691.	1250.	2392.	4270.	6581.
8972.	10957.	12143.	12381.	11605.	10222.	8758.	7395.	6211.	5704.
4359.	3651.	3058.	2562.	2145.	1797.	1505.	1261.	1056.	885.
741.	621.	520.	435.	364.	304.	253.	210.	169.	134.
97.	31.	16.	4.	2.	0.	0.	0.	0.	0.

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
12381.	11047.	5443.	2717.	135870.
CFS	7.61	15.00	15.60	15.60
INCHES	5481.	10801.	11235.	11235.
AC-FT				

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 5

8.	36.	101.	224.	453.	864.	1563.	2990.	5337.	8226.
11215.	13697.	15179.	15477.	14507.	12777.	10947.	9244.	7764.	6505.
5443.	4564.	3823.	3202.	2682.	2247.	1882.	1576.	1320.	1106.
926.	776.	650.	544.	455.	380.	316.	262.	211.	167.
122.	38.	20.	5.	2.	0.	0.	0.	0.	0.

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
15477.	13809.	6803.	3397.	169837.
CFS	9.52	18.75	19.50	19.50
INCHES	6851.	13501.	14043.	14043.
AC-FT				

HYDROGRAPH ROUTING

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	1	0	0	0	0	0
ROUTING DATA						
QLOSS	CLOSS	AVG	IRES	ISAME	ISX	STORA
0.0	0.00	0.00	1	1	0.000	-1.
NSIPS	NSIDL	LAG	AMSKK	X	TSK	STORA
0	0	0.000	0.000	0.000	0.000	-1.

2.	2.	2.	3.	5.	9.	16.	29.	53.	92.
405.	811.	1399.	1886.	2267.	2425.	2407.	2274.	2077.	1856.
1650.	1473.	1293.	1126.	974.	837.	724.	655.	599.	526.
467.	413.	364.	320.	280.	246.	213.	195.	160.	139.
119.	93.	94.	91.	98.	85.	83.	81.	78.	75.

4.	4.	5.	8.	13.	23.	43.	79.	144.	250.
390.	546.	693.	811.	887.	919.	915.	884.	849.	805.
759.	711.	666.	625.	596.	552.	522.	494.	466.	440.
416.	393.	373.	355.	338.	323.	310.	293.	288.	279.
271.	263.	256.	248.	241.	236.	227.	220.	214.	207.

STATION	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
PEAK	2425.	1218.	631.	31548.
JFS	1.53	3.36	3.62	3.62
INCHES	1103.	2417.	2609.	2609.
AC-FT				

3.	3.	4.	6.	10.	17.	31.	57.	153.	617.
1478.	2610.	3763.	4681.	5436.	5469.	5011.	4549.	4104.	3619.
3147.	2754.	2385.	2049.	1750.	1541.	1333.	1155.	992.	848.
728.	657.	590.	526.	467.	412.	363.	318.	277.	241.
208.	176.	146.	120.	99.	94.	31.	83.	85.	81.

4.	9.	11.	16.	26.	47.	85.	157.	286.	478.
713.	956.	1169.	1327.	1405.	1406.	1366.	1304.	1228.	1145.
1063.	984.	911.	843.	783.	728.	678.	632.	591.	555.
524.	434.	466.	440.	416.	393.	373.	354.	337.	322.
308.	295.	283.	272.	263.	255.	248.	240.	233.	226.

STATION	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
PEAK	5449.	2553.	1307.	65341.
JFS	4872.	7.04	7.50	7.50
INCHES	3.36	5066.	5403.	5403.
AC-FT	2417.			

5.	5.	6.	9.	14.	25.	47.	86.	473.	1145.
2787.	4553.	6966.	9473.	11744.	1345.	1486.	1659.	1569.	1406.
4325.	3813.	3310.	2882.	2499.	2149.	1837.	1606.	1397.	1237.
1038.	898.	758.	677.	509.	584.	493.	427.	375.	328.
284.	241.	201.	165.	116.	111.	95.	92.	90.	87.

STATION	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
PEAK	8874.	3900.	1985.	99226.
JFS	7790.	10.75	11.40	11.40
INCHES	5.37	7740.	8205.	8205.
AC-FT	3855.			

12.	13.	16.	24.	39.	70.	128.	235.	418.	677.
991.	1305.	1545.	1667.	1834.	1659.	1593.	1511.	1426.	1347.
1266.	1178.	1092.	1010.	933.	863.	801.	745.	692.	645.
603.	565.	532.	503.	474.	447.	422.	399.	378.	358.
340.	322.	305.	291.	278.	268.	260.	252.	245.	237.

STATION	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
PEAK	8874.	3900.	1985.	99226.
JFS	7790.	10.75	11.40	11.40
INCHES	5.37	7740.	8205.	8205.
AC-FT	3855.			

6.	6.	8.	12.	19.	34.	62.	110.	199.	2174.
4215.	7446.	10503.	11953.	11951.	11157.	9877.	8695.	7319.	6318.
5163.	4619.	4129.	3618.	3133.	2735.	2363.	2027.	1743.	1524.
1323.	1141.	779.	617.	721.	651.	583.	519.	460.	404.

1398.	1317.	1232.	1144.	1060.	990.	906.	839.	779.	724.
674.	628.	588.	552.	521.	492.	464.	437.	413.	389.
368.	346.	325.	307.	292.	280.	269.	261.	253.	245.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
3FS	11961.	10641.	5251.	2663.	133149.
INCHES		7.33	14.47	15.23	15.23
AC-FT		5279.	10420.	11010.	11010.

	STATION	2, PLAN 1, RTIO 5
8.	10.	24.
6107.	10573.	15077.
6598.	4750.	3755.
1581.	1187.	872.
412.	293.	199.

	STOR	213.	382.	658.	1041.
21.	27.	39.	117.	1701.	1605.
1466.	1997.	2075.	2006.	856.	794.
1511.	1339.	1257.	1082.	443.	417.
734.	640.	598.	529.	259.	251.
393.	344.	323.	290.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
3FS	15077.	13393.	6597.	3342.	167094.
INCHES		9.23	18.18	19.19	19.19
AC-FT		6645.	13092.	13817.	13817.

PEAK FLOW SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

OPERATION	STATION	PLAN	RATIOS APPLIED TO FLOWS			
			.20	.40	.60	.80 1.00
HYDROGRAPH AT ROUTED TO	1	1	3095.	5191.	9296.	12381. 15477.
	2	2	0.	0.	0.	0.
	1	1	2425.	5449.	9874.	11961. 15077.
	2	2	0.	0.	0.	0.

APPLICATION DATA AND PREVIOUS INSPECTION REPORT

STATE OF NEW YORK
DEPARTMENT OF

State Engineer and Surveyor

ALBANY

Received Dec 22 1926 Dam No. 555 111 Watershed
Disposition Approved Serial No. 555 2611
Foundation inspected _____
Structure inspected _____

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the State Engineer, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended, for the approval of specifications and detailed drawings, marked _____

herewith submitted for the { construction / reconstruction } of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about Nov 1926
(Date)

- The dam will be on Guswadek Creek flowing into Hudson River in the town of Newburgh, County of Orange and 1700' North of intersection of the Newburgh Fall Hill and Cronauer Valley placed at the mouth of a stream
- The name and address of the owner is Newburgh Blooming, Newburgh, N. Y.
- The dam will be used for Power, Manufacturing, purposes, Real Estate
- Will any part of the dam be built upon or its pond flood any State lands? No development
- The watershed at the proposed dam draining into the pond to be formed thereby is 13.6 square miles.
- The proposed dam will have a pond area at the spillcrest elevation of 260 acres and will impound 500,000,000 cubic feet of water.
- The lowest part of the natural shore of the pond is 1.6 feet vertically above the spillcrest, and everywhere else the shore will be at least 20 feet above the spillcrest.
- The maximum flow of the stream at the dam site was 1100 cubic feet per second on Nov 1, 1926 at 11:00 A.M. Rainfall 1.5 in (24 hr)
- State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam. Failure of the dam would cause damage to the property of the owner and other property in the vicinity of the dam.
- The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, slate, limestone, etc.) clay, sand, gravel, boulders, granite

11. The material of the right bank, in the direction with the current, is Shale; at the spillcrest elevation this material has a top slope of 2" inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of 40 feet, and the top surface extends for a vertical height of _____ feet above the spillcrest.

12. The material of the left bank is Hard clay has a top slope of 4 inches to a foot horizontal, a thickness of unknown feet, and a height of 25 feet.

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. Shale, hard. Outcrop shows some weathering. Clay hard, blue. Practically impervious.

14. If the bed is in layers, are the layers horizontal or inclined? Inclined If inclined what is the direction of the horizontal outcropping relative to the axis of the main dam and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping Horizontal outcropping about 30° in relation to axis of dam. Inclination of layers 40° from perpendicular.

15. What is the thickness of the layers? About 6"

16. Are there any porous seams or fissures? No

17. WASTES. The spillway of the above proposed dam will be 175 feet long in the clear; the waters will be held at the right end by a concrete bulkhead the top of which will be 5 feet above the spillcrest, and have a top width of 2 feet; and at the left end by a Concrete bulkhead the top of which will be 5 feet above the spillcrest, and have a top width of 4 feet.

18. There will be also for flood discharge a pipe 26" inches inside diameter and the bottom will be 30 feet below the spillcrest, a sluice or gate 26" in diameter feet wide in the clear by _____ feet high, and the bottom will be 30 feet below the spillcrest. Also 2-30" pipes with 30" gate valves 10' below spillcrest

19. APRON. Below the proposed dam there will be an apron built of Spillway fill to an 10' below spillcrest feet long across the stream, _____ feet wide and _____ feet thick. The downstream side of the apron will have a thickness of _____ feet for a width of _____ feet.

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings in triplicate of the proposed structure, one set of which will be returned if they are approved. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam; of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape,

the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the dam.

The accompanying drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the application any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer. State the assumed ice and uplift pressures and the conditions on which based.

21. **SKETCHES.** For small and unimportant structures, if plans have not been made, on the back of this application make a sketch to scale for each different cross-section at the highest point; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillcrest; and outline the apron. Also sketch an elevation of each end of the dam with a cross section of the banks, giving the depth and width excavated into the banks.

22. **ELEVATIONS.** Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at the ends of the spill; of the spillcrest for the above proposed dam; and of the spillcrest of any adjacent dams.

23. **SAMPLES.** When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand, one-half a cubic foot is desired (exclusive of any stone over $\frac{1}{2}$ inch in size mixed therewith); for cement, three pints; and for the natural bed, twenty cubic inches if of ledge and one-half a cubic foot if of soil.

24. **INSPECTION.** State how inspection is to be provided for during construction.

Consentent Engineer employed by the Owner.

25. **WATER SUPPLY.** Are the waters impounded by the above dam to be used for a public water supply? No
Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y? No

FORM 1 - INVENTORY OF 10-15-46 THE UNITED STATES
 (SUBMIT TO PUBLIC LAW 9-367)

See also inside of the folder

GENERAL INFORMATION		FACILITY CAPACITY		NAVIGATION									
NAME	LOCATION	DESIGNED	ACTUAL	DEPTH	BEAM	LENGTH	WIDTH	HEIGHT	DEPTH	BEAM	LENGTH	WIDTH	HEIGHT
1	175												

NAME	ENGINEERING BY	CONSTRUCTION BY
NEW YORK CITY OF NEW YORK		

NAME	REGULATORY AGENCY	OPERATION

NAME	REGISTRATION	DATE	AUTHORITY

NAME	REGISTRATION	DATE	AUTHORITY
1-01-523	00-UNKNOWN	33-UNKNOWN	34-UNKNOWN

Depositing Monthly

18365

ft.

7

4th 200,000,000

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	
1943	1.43	1.03	4.09	1.01	1.39	3.37	3.23	1.51	1.62	2.23	2.63	3.73	2.23
1944	13.53	1.17	6.94	3.17	3.93	3.79	2.61	3.62	9.89	3.93	2.32	3.21	5.86
1945	17.72	3.83	3.13	4.17	3.69	3.15	3.77	3.13	1.61	3.33	5.12	0.93	5.97
1946	21.33	3.34	4.47	4.49	2.93	0.99	11.67	2.57	11.94	2.01	10.13	1.77	1.0
1947	41.23	3.33	2.29	2.37	3.33	3.13	3.35	3.99	3.23	5.01	4.07	1.33	2.33
1948	59.23	6.13	1.29	4.09	2.93	3.69	2.73	4.22	5.31	3.13	2.20	3.22	2.33
1949	69.37	1.43	2.03	3.37	3.91	3.37	2.93	7.91	3.13	2.12	3.39	1.54	2.71
1950	31.23	4.39	2.49	3.39	2.23	3.99	3.12	2.61	0.93	9.64	7.69	3.39	3.37
1951	33.43	3.33	5.13	3.33	4.43	7.33	2.33	2.14	2.84	1.59	2.42	9.77	1.34
1952	43.69	4.34	3.57	3.33	6.33	2.65	3.25	3.24	5.24	3.71	1.95	3.64	3.43
1953	41.67	3.31	4.79	1.43	3.95	4.03	4.33	2.99	4.29	3.23	1.95	4.79	2.19
1954	43.29	2.93	3.37	4.43	3.13	3.93	6.01	1.99	3.75	2.67	3.19	2.35	3.93
1955	49.17	3.19	2.53	3.99	6.43	4.95	1.39	0.91	3.29	1.93	3.93	3.23	4.35
1956	47.23	3.35	2.85	6.39	4.34	3.79	0.43	0.39	4.39	3.45	3.44	2.35	3.73
1957	33.93	2.99	1.39	4.39	4.43	2.39	3.73	3.49	2.65	0.39	3.99	3.44	3.43
1958	47.57	5.54	5.53	0.13	2.93	2.79	3.95	3.59	3.57	2.73	3.93	2.99	5.33
1959	35.34	1.43	2.39	1.65	2.57	7.29	4.24	3.57	1.99	3.64	0.39	3.59	2.53
1960	39.93	2.29	1.29	3.41	1.79	3.95	4.04	2.17	4.15	1.94	5.35	0.99	1.69
1961	36.67	2.33	2.53	1.11	2.99	2.35	1.99	2.29	2.33	3.37	1.59	2.37	3.73
1962	33.33	2.33	2.33	1.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33

Heidelberg W. J.

<u>La Number</u>	<u>River Basin</u>	<u>Town</u>	<u>County</u>	<u>Hazard Class*</u>	<u>Date & Inspector</u>
593	L. Hudson	Andover	Orange	C	9/1/72 K

Use

- ☒ Water Supply
☐ Power
☒ Recreation
☐ Fish and Wildlife
☐ Farm Pond
☐ No Apparent Use-Abandon

Estimated Height of Dam above Streambed

- | | |
|-------------------------------------|---------------|
| <input type="checkbox"/> | Under 10 feet |
| <input type="checkbox"/> | 10-25 feet |
| <input checked="" type="checkbox"/> | Over 25 feet |

☒ Service satisfactory ☒ Auxiliary satisfactory

☐ In need of repair or maintenance ☐ In need of repair or maintenance

☒ Satisfactory
☐ In need of repair or maintenance Explain: _____

Yes

☒ Satisfactory

☐ In need of repair or maintenance Explain: _____

☒ No defects observed beyond normal maintenance

☐ Repairs required beyond normal maintenance

1. Captain Edward Clark, Jr.

STABILITY ANALYSES

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. _____ OF _____

DATE 8/27/18

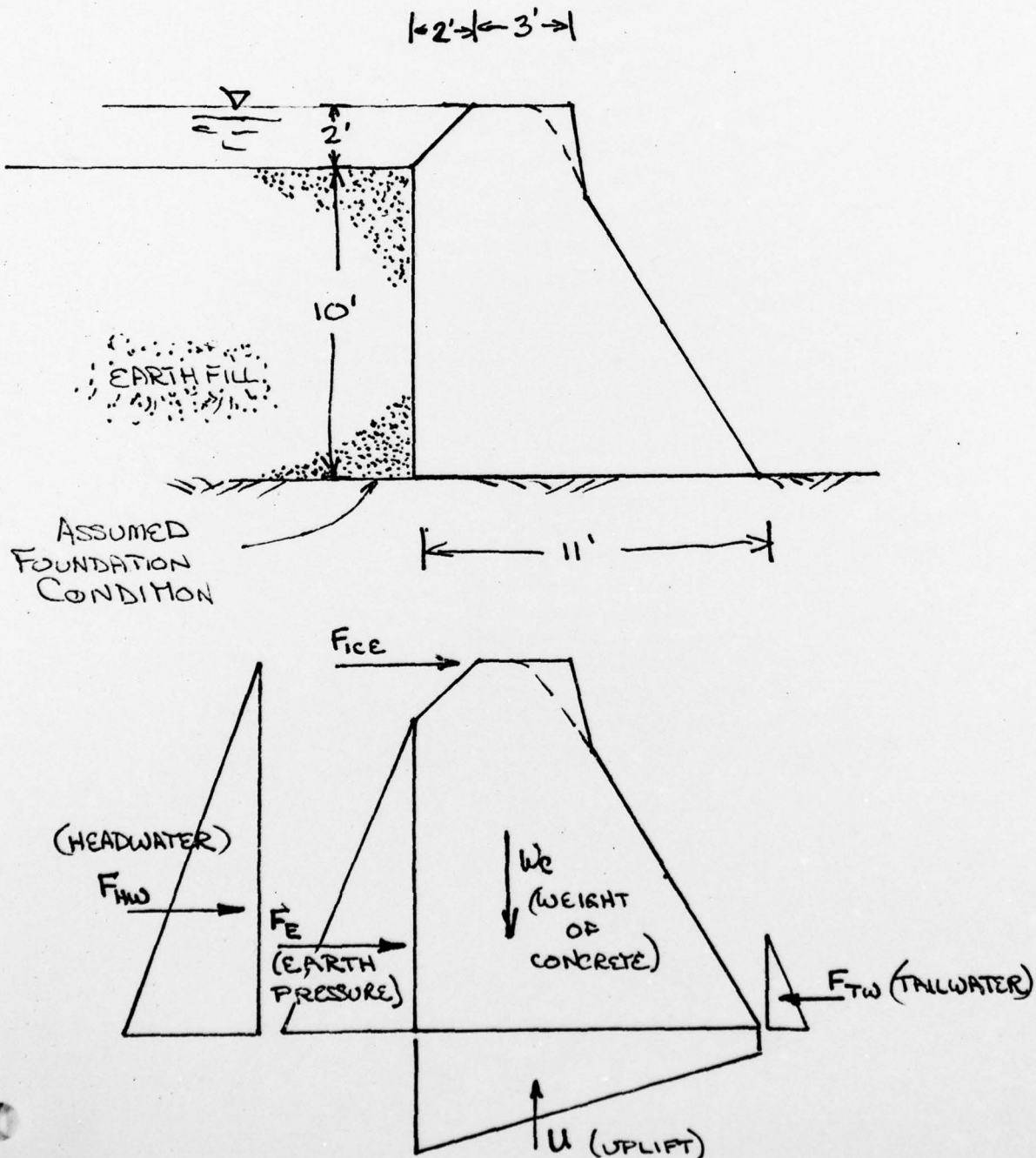
NAME OF CLIENT NYSDEC

COMP. BY DBC

PROJECT CHADWICK LAKE DAM

CHECKED BY _____

SPILLWAY STABILITY ANALYSIS



STABILITY ANALYSIS-CHADWICK LAKE SPILLWAY
NORMAL POOL

BASE ELEVATION= 438.00FT. TOP ELEVATION= 450.00FT. BASE WIDTH= 11.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 450.00FT. TAILWATER ELEVATION= 0.00FT. EARTHQUAKE ACCELERATION= .000G (HORIZ) .000G (VERT)
SILT ELEVATION= 448.00FT. SILT DENSITY(SUBMERGED)= 95.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 11.00FT. FRICTION FACTOR= .60

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION PERCENT OF
HEADWATER

0.00 0.00
11.00 50.00

LOADING FORCE(KIPS) ARM(FFET) STABILIZING MOMENT OVERTURNING MOMENT

WEIGHT OF DAM 13.20 6.84 90.24 17.95
HEADWATER 4.49 4.00 15.10
UPLIFT 2.06 7.33 5.27
SILT 1.58 3.33 *****
90.24 38.33

NET HORIZONTAL FORCE= 6.07 KIPS
NET VERTICAL FORCE= 11.14 KIPS
NET MOMENT= 51.91 KIP-Feet
X-BAR OF FOUNDATION REACTION= 4.66 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= .84 FEET
FOUNDATION PEAK PRESSURES*****TOE= 10.24 PSI*****HEEL= 3.82 PSI*****
OVERTURNING FACTOR OF SAFETY= 2.35
SLIDING FACTOR OF SAFETY= 1.10
DEVELOPED FRICTION FACTOR (NO SHEAR)= .55
SLIDING WITH SHEAR FACTOR OF SAFETY= 14.14 (SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS-CHADWICK LAKE SPILLWAY NORMAL POOL AND EARTHQUAKE(A=.025G)

TOP ELEVATION= 450.00FT. TOP ELEVATION= 450.00FT. BASE WIDTH= 11.00FT. DENSITY= 145.00PCF
 ELEVATION= 450.00FT. TAILWATER ELEVATION= 0.00FT. EARTHQUAKE ACCELERATION=.025G (HORIZ) .000G (VERT)
 ELEVATION= 450.00FT. SILT DENSITY(SUBMERGED)= 95.00PCF SILT PRESSURE COEFFICIENT(K)= .33
 SHEAR WIDTH= 50.00FT. SHEAR WIDTH= 11.00FT. FRICTION FACTOR= .60

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION PERCENT-OF
 HEADWATER
 0.00
 50.00

LOADING FORCE(KIPS) ARM(Feet) STABILIZING MOMENT OVERTURNING MOMENT

WEIGHT-OF-DAM 13.20 6.84 90.24
 HEADWATER 4.49 4.00 17.95
 UPLIFT 2.06 7.33 15.10
 EARTHQUAKE INDUCED LOADINGS
 INERTIA-WATER .12 4.80 .59
 HORIZONTAL INERTIA-DAM .33 5.06 1.67
 SILT 1.50 3.33 5.27
 90.24 40.59

NET HORIZONTAL FORCE= 5.53 KIPS
 NET VERTICAL FORCE= 11.14 KIPS
 NET MOMENT= 43.66 KIP-Feet
 X-BAR OF FOUNDATION REACTION= 4.46 FEET
 COEFFICIENT OF FOUNDATION REACTION FROM CENTER= 1.04 FEET
 FOUNDATION REACTION PRESSURES= 11.02 PSI *****HEEL= 3.04 PSI *****
 OVERTURNING FACTOR OF SAFETY= 2.22
 SLIDING FACTOR OF SAFETY= 1.02
 DEVELOPED FRICTION FACTOR (NO SHEAR)= .59
 SLIDING WITH SHEAR FACTOR OF SAFETY= 13.16(SHEAR ACROSS FULL BASE WIDTH)

STABILITY ANALYSIS-CHADWICK LAKE SPILLWAY
 MAXIMUM NONOVERTOPPING POOL

BASE ELEVATION= 438.00FT. TOP ELEVATION= 450.00FT. BASE WIDTH= 11.00FT. DENSITY= 145.00PCF
 HEADWATER ELEVATION= 455.00FT. TAILWATER ELEVATION= 445.00FT. EARTHQUAKE ACCELERATION= .000G (HORIZ) .000G (VERT)
 SILT ELEVATION= 443.00FT. SILT DENSITY(SURGERED)= 95.00PCF SILT PRESSURE COEFFICIENT(K)= .13
 SHEAR STRESS= 50.00PSI SHEAR WIDTH= 11.00FT. FRICTION FACTOR= .60

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION PERCENT OF
 HEADWATER
 0.00 30.00
 11.00 50.00

LOADING	FORCE(KIPS)	ARM(Feet)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	13.20	6.84	90.24	
HEADWATER	8.24	4.91		40.44
TAILWATER	1.53	2.33	3.56	
UPLIFT	4.67	5.96		27.81
SILT	1.58	3.33		5.27
			93.80	73.52

NET HORIZONTAL FORCE= 8.29 KIPS
 NET VERTICAL FORCE= 8.53 KIPS
 NET MOMENT= 20.28KIP-Feet
 X-BAR OF FOUNDATION REACTION= 2.38 FEET
 ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 3.12 FEET
 *****FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
 FOUNDATION REACTION PRESSURES*****TOE= 14.55 PSI*****HEEL= -3.78 PSI*****
 OVERTURNING FACTOR OF SAFETY= 1.28
 SLIDING FACTOR OF SAFETY= .62
 DEVELOPED FRICTION FACTOR (NO SHEAR)= .97
 SLIDING WITH SHEAR FACTOR OF SAFETY= 10.17(SHEAR ACROSS FULL DASE WIDTH)

STABILITY ANALYSIS-CHANNICK LAKE SPILLWAY
NORMAL POOL AND ICE LOAD

BASE ELEVATION= 439.00FT. TOP ELEVATION= 450.00FT. BASE WIDTH= 11.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 450.00FT. TAILWATER ELEVATION= 0.00FT. EARTHQUAKE ACCELERATION= 0.00G (HORIZ), 0.00G (VERT)
SILT ELEVATION= 448.00FT. SILT DENSITY(SUBMERGED)= 95.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI--SHEAR WIDTH= 11.00FT. FRICTION FACTOR= .60

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION PERCENT OF HEADWATER

0.00
11.00 50.00

LOADING	FORCE(KIPS)	ARM(Feet)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	13.20	6.84	90.24	17.95
HEADWATER	4.49	4.00		15.10
UPLIFT	2.06	7.33		5.27
SILT	1.58	3.33		55.00
ICE LOAD	5.00	11.00		93.33

NET HORIZONTAL FORCE= 11.07 KIPS
NET VERTICAL FORCE= 11.14 KIPS
NET MOMENT= -3.09 KIP-Feet
X-BAR OF FOUNDATION REACTION= -28 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 5.74 FEET
*****FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
FOUNDATION REACTION PRESSURES*****TOE= 29.18 PSI*****HEEL= -15.12 PSI*****
OVERTURNING FACTOR OF SAFETY= .97
SLIDING FACTOR OF SAFETY= .60
DEVELOPED FRICTION FACTOR (NO SHEAR)= .99
SLIDING WITH SHEAR FACTOR OF SAFETY= 7.75(SHEAR ACROSS FULL BASE WIDTH)